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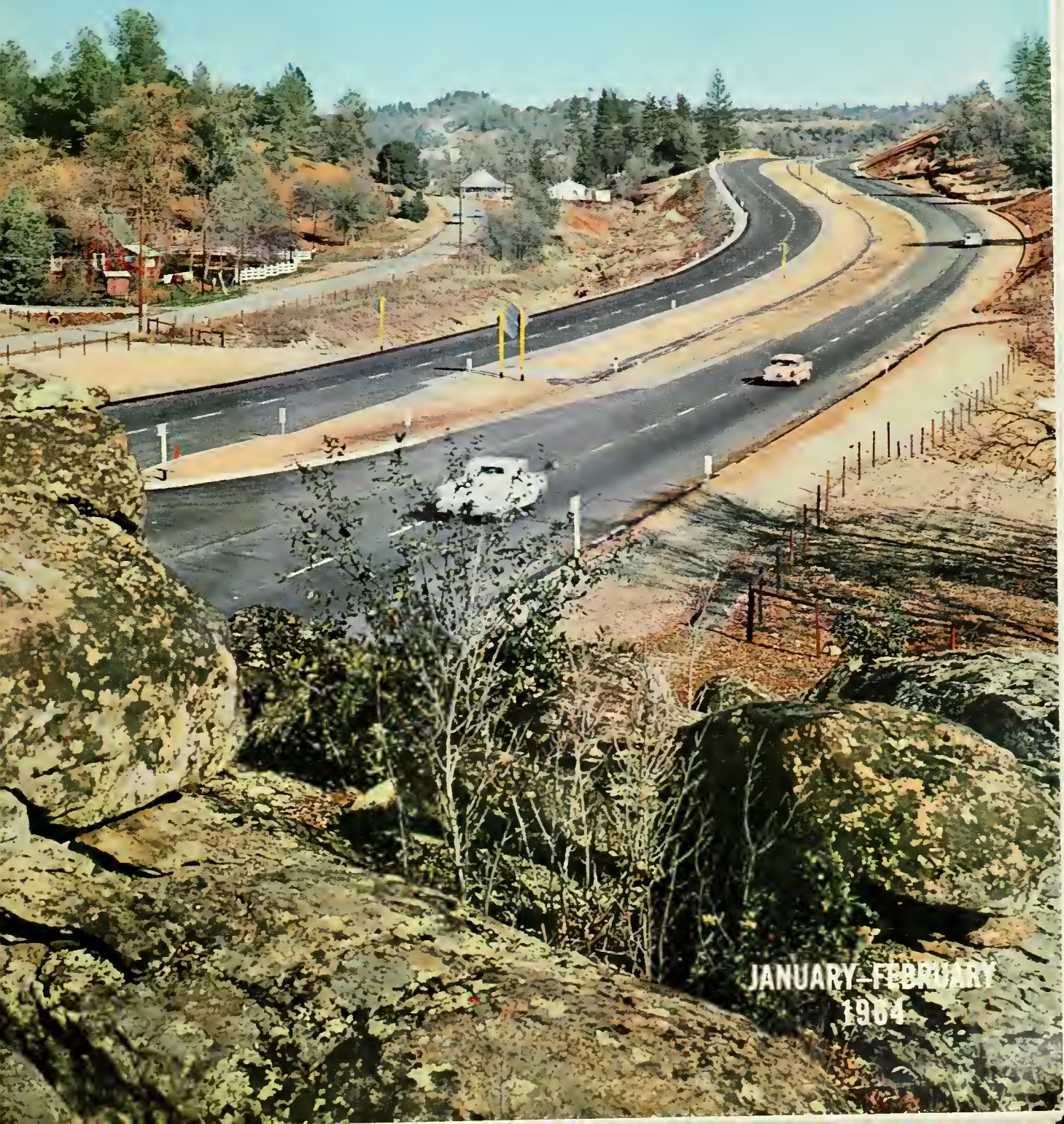

JANUARY–FEBRUARY
1964

All Contracts Include Fair Employment Provisions

Standard fair employment practices provisions, backed up by compliance reports, are now a part of all construction contracts administered by the Division of Highways. These provisions apply not only to major construction jobs, but also to right-of-way clearance contracts, informal bid and minor contracts, and any other service contracts which involve employment of labor.

Where federal aid funds are involved in highway projects, there have been federal government requirements in effect for some time which prohibit discrimination by the contractor because of race, creed, color or national origin.

On all other construction contracts administered by the Division of Highways, the long-standing provision of the State Labor Code to this effect is now amplified and strengthened by new fair employment practices provisions issued pursuant to Governor Edmund G. Brown's Code of Fair Practices. These provisions are spelled out in Department of Finance Management Memo No. 63-20.

Under these provisions, each contractor to whom work is awarded agrees as follows:

> (1) The contractor will not willfully discriminate against any employee or applicant for employment because of race, color, religion, ancestry, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, ancestry, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the awarding authority setting forth the provisions of this fair employment practices section.

In addition, the contractor is required, among other things, to:

—Advise labor unions of his fair employment practices commitments and attempt through labor negotiations to "implement an affirmative antidiscrimination program . . . to the end that qualified minority workers will be available and given an equal opportunity for employment."

—Submit, before the contract is awarded, a signed statement he will take positive action to notify his own staff and all employment sources of the contents of the antidiscrimination clause. (Posters and notices are supplied by the Division of Highways.)

—Agree to permit access to his employment records by the Fair Employment Practices Commission or other appropriate state authority for investigation to ascertain compliance.

—Include these fair employment practices provisions in subcontracts.

The provisions also provide for penalties for "willful violation" of this section of the contract. These may include monetary damages and revocation of the contractor's prequalification or his eligibility as a "responsible bidder."

Two compliance reports are required on all contracts amounting to more than $5,000. The first one, containing detailed questions on the steps taken to carry out the FEP policies and procedures, must be filed within 90 days of the approval of the contract (within 10 days if completion is expected within 90 days). A final report is required after completion of the contract. On contracts less than $5,000 one report is required.

The department's policy in this regard was stated by Director of Public Works John Erreca in a recent circular calling attention to Governor Brown's expressed concern that "the task of achieving equal opportunity for all our citizens continue with a renewed sense of urgency."

"I want to be sure," Erreca said, "that both formally and informally our department does everything possible to support and to strengthen the carrying out of this vital public policy."

State Highway Engineer J. C. Womack, in a followup circular letter, called the attention of all district engineers and other staff officials to this policy and emphasized the "necessity for immediate and full compliance."

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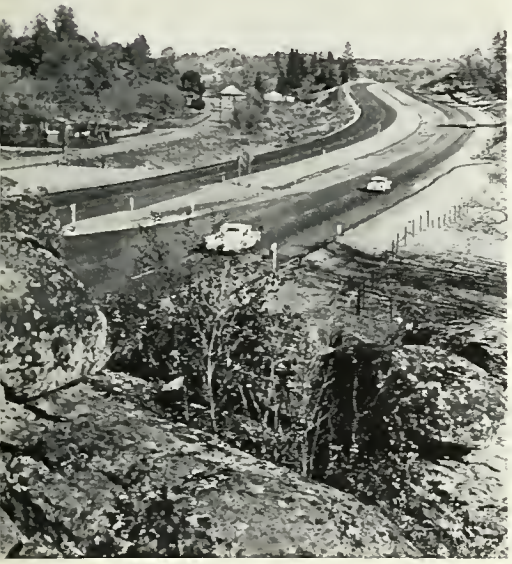

FRONT COVER: Illustrated is the new section of expressway west of Twain Horte on Sign Route 108 (Sonora Pass Highway), Tuolumne County. This is a popular route for winter sports enthusiasts and summer recreationists also. Photo by Robert Mulno.

BACK COVER: Rotory plow throws snow from windrows placed by fixed plows on Interstate Route 80 near Kingvale. Picturesque humps in foreground are piles of snow thrown clear after a previous storm, and since clothed with several inches of fresh snow. Photo by Robert Dunn.

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TECHNOLOGY

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Antelope Valley Freeway

By CAROLE KRETZER, Assistant Information Officer

The 2,500-square-mile Antelope Valley is a right triangle with one side pushing across the entire northern boundary of Los Angeles County and another side leaning against the county's eastern boundary as far south as Route 59. Its hypotenuse is formed by the San Gabriel Mountains, and it is only through this range that motorists from Greater Los Angeles can reach the valley.

Until last October, there were two principal connections between the valley and the metropolitan area to which its economy is tied. Motorists from the San Fernando Valley could enter via Newhall on the state facility (Sierra Highway) or the county's Soledad Canyon Road. Or from the San Gabriel Valley, they could travel the scenic but twisting Angeles Crest-Angeles Forest route.

Neither choice was particularly desirable. Both are two-lane facilities with curves and hills that limit passing opportunities. A relatively high percentage of truck traffic (10 percent of the total) passes from Los Angeles to the Antelope Valley, and automobiles pulling trailers or boats toward the High Sierra also slow the traffic pace.

Last October 15, the situation was eased considerably as the barriers were removed from the first 14.4-mile stretch of the Antelope Valley Freeway—an important segment which climbs from an elevation of 1,437 feet at Soledad Canyon Road, near Solemint, to Ward Road Overcrossing just a little southeast of the 3,262-foot summit.

The facility is a modern four-lane freeway with an extra lane provided for trucks wherever the uphill grade is 3 percent or more, or the downhill grade is at its 4½ percent maximum. The median is wide, separating traffic by 22 feet at minimum and 72 feet at maximum. Two miles shorter than old Sierra, the freeway saves motorists 1,000 hours a day travel time and is expected to prevent 45 accidents and save 7 lives a year.

Although this new segment feeds into Sierra Highway at both ends, it is some three miles from the old route much of the way, moving through virtually untouched territory in parts. It affords motorists a view not visible from old Sierra as it passes through the scenic Vasquez Rocks, where the notorious Mexican bandit holed up in the 1850's.

Welcomed by the Valley

"This first link is the wedge that will open the heretofore bottled-up potential of the Antelope Valley," said Lamont Odett, general chairman of the Antelope Valley Freeway Committee at the dedication August 23. "As additional sections are completed, the reality of what this freeway can mean to us will become even more apparent."

His sentiments are typical of all Valleyites who have pinned their ambitious growth plans largely on the availability of water and the completion of the freeway from the Golden State Freeway to the Kern county line. Although this freeway will never bear the heavy traffic of metropolitan freeways, it is a federal aid primary route and is important as a defense road, as an access route to recreational areas, and as a connector to busier freeways in the Los Angeles area.

Will Be Complete by 1970

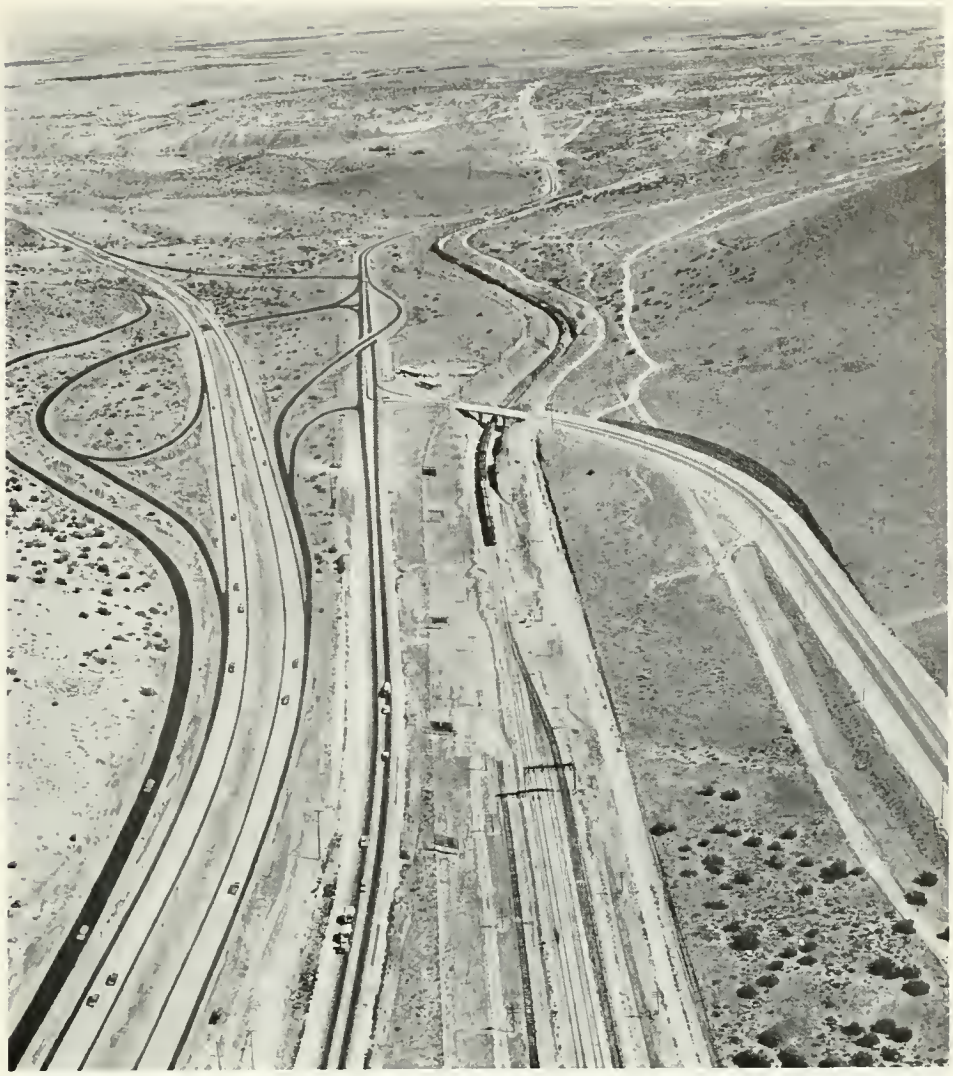
As plans currently stand, and subject to future California Highway Commission budgets, the valley should have its freeway completed to the total length in Los Angeles County (50.5 miles) around 1970. Total construction cost is estimated at $52.6 million, and about $7 million will be invested in rights-of-way. It will have taken about 10 years to construct, and some portions will have been 50 percent financed by federal funds. Formerly signed as U.S. Highway 6, the road is designated as Route 14 under legislation enacted in 1963.

Beginning at the western (or southern) terminus, the timetable now looks like this:

Golden State Freeway (Interstate 5) to Soledad Canyon Road near Solemint, 7.5 miles, tentatively scheduled for construction in about three years.

Soledad Canyon Road to Ward Road Overcrossing, 14.4 miles, complete and opened to traffic October 15, 1963.

Ward Road Overcrossing to Vincent, 7.6 miles, under construction since October 1963 and scheduled for completion in May 1965.



Now under construction, the Antelope Valley Freeway (artist's rendering at left) will contrast sharply with the two existing roadways at right. Sierro Highway is center with the Angeles Forest Highway coming in from the right. This busy junction is located near Vincent.

Vincent to Avenue P8 near Palmdale, 5.9 miles, included in the 1964-65 fiscal year budget.

Avenue P8 to Avenue I northwest of Lancaster, 7.2 miles, tentatively scheduled for stage construction, with contracts to be awarded in three to four years.

Avenue I to Kern county line, 7.9 miles, tentatively scheduled for stage construction, with contracts to be awarded in one to two years.

Right-of-way and Design

Approximately half the right-of-way for the entire route has been acquired. Only 427 parcels are needed, and the average right-of-way cost per mile runs about $140,000, a very low figure in District VII.

Design of the route, which is also about halfway complete, features a wide median throughout, the maximum being 130 feet for the ultimate eight lanes on the contract currently going just west of Vincent. According to District Design Engineer Wallace Griffin, this feature permitted design of the opposing roadways to be treated as separate units, with the result that grading problems were eased and special consideration could be given to aesthetics and reduction of headlight glare.

Initially, the freeway will be a basic four-lane facility throughout, with passing lanes built as needed, especially through the mountains.

Crosses Diverse Terrain

The Antelope Valley Freeway will have two distinct characteristics. It will curve east by northeasterly through rugged, mountainous terrain for about half its length, then dogleg almost due north at Vincent through the flat, high desert known as Antelope Valley.

Through the mountains, the primary design problem was to achieve alignment and grade that would be compatible with safety and high speed. The 14.4-mile stretch now open to traffic settles well into the terrain, and although it traverses numerous faults, all structures are founded on a solid base. Irregular attitude of the bedding in the fault areas caused only minor problems in stabilizing the slopes.

Large Earthmoving Job

Grading for this completed portion required one of the largest excavation jobs in recent years. The original contract, awarded in December 1960, at $7,400,000, to Darkenwald Construction Company, Inc., and Morrison-Knudsen, Inc., required removal of 7,700,000 cubic yards of earth and rock to create a roadbed 140 feet wide along a 10-mile stretch. Using 27 tractors, 24 scraper and truck-type hauling units, and two conveyor-type belt loaders, the contractors moved up to 31,000 cubic yards per eight-hour day, averaging 20,000 cubic yards, to complete the job in September 1962.

An additional contract, awarded in November 1961, at $6,600,000, involved removal of another 1,800,000 cubic yards by Frederickson & Watson, Kirst & Jack L. Adams Construction Companies in a joint venture, for a total earth removal of 9,500,000 cubic yards. Although this total comes nowhere near the mammoth 18,000,000 cubic yards removed from the Santa Monica Mountains to accommodate the San Diego Freeway, the Antelope Valley project required earth excavation from numerous locations along the 16-mile contract limits, and involved 100,000,000 station yards of overhaul. Cuts along the route ran as deep as 200 feet and fills as high as 180 feet.

This excavation was also of special interest because it acted as a check on the first seismic tests conducted in District VII to determine rippability of rock. Back in 1960, prior to award of the grading contract, the Engineering Services Department set off small dynamite charges in cut areas along the route and, using sensing equipment which measures the speed of seismic waves, related the speed to density of material and estimated the cubic yards of material that could not be removed without blasting. Although the contractor was able to rip 9.2 percent more material without dynamiting than the estimate had indicated he could, the error was considered reasonable for "testing the test." Further, because of poor access, usual methods of calculating rippable material would have been highly impractical. (See *California Highways and Public Works*, May-June 1960 and 1963.)

Sometime during the 1964-65 fiscal year, construction of the Antelope Valley Freeway will move north out of the mountains and into the desert. Intersecting road rendered in the foreground is future Avenue R. The road parallel to the rendering of the freeway is Division Street. Water at upper left is Palmdale Reservoir.

Mountain Drainage

In addition to calculating extensive earthwork problems, District VII design engineers had to plan a large drainage system through the mountains to accommodate heavy runoff from the high canyons.

Reinforced concrete arch culverts with special structural design to withstand high overfills were used in the higher terrain. These culverts are unusually large for Southern California, each being 400 to 500 feet long and up to 17 feet in span. If laid end to end, the culverts necessary for the 14.4-mile route would stretch 9 miles.

Not the least problem in installing the culverts was that the contractors

had to haul the concrete for some of these drains without benefit of roadways along two miles of the Vasquez Rocks area. Other problems arose in blasting and in placing the culverts in the craggy rocks. For one of the 14-foot arch culverts, 60 percent of the foundation area into which it was fitted had to be dynamited, and the culvert had to be placed to follow the smooth, flat curve of a streambed for about 400 feet.

Santa Clara River

The close proximity of the Santa Clara River to the freeway for about three miles from Solemint west made it necessary to provide additional slope protection at intermittent points. Because the river occasionally reaches a flood stage of 131,000 cubic feet per second current flow, a special stone protection was needed for embankment slopes. Built to a depth of anticipated scour about six feet below and six feet above the streambed, the special embankment was constructed from rock extracted from the job farther east.

When it came to developing water, however, the river was a blessing. Pumping from the Santa Clara River, the contractors developed six reservoirs along the line. They had to install about 60,000 lineal feet of pipeline nearly 9 inches in diameter to supply water for roadbed compaction. The water system alone cost the first contractor about $500,000, exclusive of application, and with further water development accomplished by the second contractor, a total of nearly 12 miles of pipeline was installed at a cost of about $700,000.

Resident Engineer Howard Meinke estimates that three months could have been saved had water been more easily obtainable and had access to the freeway site been easier. From preliminary survey work through actual construction, a four-mile area between Agua Dulce Canyon Road and Escondido Canyon Road was extremely difficult to reach. After preliminary survey crews reported that it took two hours to reach the Vasquez Rocks area and another two to return, primitive access roads were bulldozed to the roadway site. Even then, the heavy earth-

OLD. Traffic using Sierra Highway last August, before opening of the Antelope Valley Freeway, was often slowed by hills and curves through the mountains, such as on this section through Mint Canyon northeast of Solemint.

NEW. The new Antelope Valley Freeway looking southwest about a mile east of Agua Dulce Canyon Road. The graded roadbed width is sufficient to accommodate an ultimate eight lanes.

An orch culvert under construction on the Antelope Valley Freeway. Photo by Morrison-Knudsen Company.

A 17-foot reinforced concrete orch culvert provides drainage just west of Agua Dulce Canyon Road. The embankment is 90 feet high.

moving equipment that later moved in found the going rough.

Moteriol Site Purchosed

An equally important problem—the dearth of nearby commercial material sites—was solved with the State purchase of a materials site about five miles east of Solemint. Had the site not been purchased and developed, material would have had to be hauled from Little Rock or the San Fernando Valley, some 20 to 25 miles from various points along the job.

Paying 3½ cents a ton, the contractor developed all construction material himself, including 630,000 tons of subbase, 295,000 tons of base material, 120,000 cubic yards of Portland cement concrete, and 100,000 tons of asphaltic concrete.

Longest Poving Job

The 16-mile job is one of the longest single concrete paving contracts ever awarded by the State. To accomplish the task, the contractor used a Gunnert-Zimmerman slip-form paver, placing both lanes (and all three, when three were specified) at once. Paving sometimes became difficult along the mountainous route, especially wherever the paver came out of one curve and went into a reverse arc where the tangents were short.

Included in this extensive concrete project is a 1½-mile test section for a shrinkage-compensated cement used in mix. The test area, which runs from Lost Canyon Bridge to Oak Springs Canyon Bridge, is divided into six quarter-mile sections. In three of them were poured air-entrained concrete —one using a normal job cement, and the two others the experimental mix at 6 sacks per cubic yard and at 6½ sacks. The same combinations were used in the other three sections, except that the concrete was non-air-entrained. The Materials and Research Department has taken shrinkage crack counts and straight gauge tests to determine the material's effectiveness and reported on the project in the September-October 1963 issue of *California Highways and Public Works.*

Desert Portion Soon Underwoy

The freeway will move out of the mountains and into the desert near

An eastward view of the new Antelope Valley Freeway from the present west end near Salemint. The interchange in middleground is Sand Canyon Road.

Check dams along the Santa Clara River are composed of steel rail and wire mesh double fences filled with rock. The view is downstream looking from the Tick Canyon Wash freeway bridge. The Southern California Gas pipeline spans the river in the left background.

A six-foot-high wall of riprap separates the left bank of the Santa Clara River from the freeway about two miles east of Solemint.

Vincent some time during the 1964-65 fiscal year. Although the difficulties of access and water will not be as great as they were at the higher elevations, the problem of locating a nearby material site will have to be met, and drainage will again be a greater-than-usual problem. For in the valley, the roadway will have to be protected not only from runoff, but also from flash floods. The Antelope Valley represents one of the largest drainage problems of its type in Southern California, because watercourses are undefined and the path that water will take toward the dry lakes is unpredictable.

Valley's Expectations

Perhaps nowhere in Southern California is the quick completion of a freeway more hoped for than in Antelope Valley. The valley remains the one major reserve of good, flat, developable land in Southern California, and valley leaders are convinced that the early 1970's will mark the beginning of a boom, as completion of the freeway meshes with the coming of imported water.

The valley's general economy is now based primarily on the aircraft-missile industry, which is centered almost exclusively at Edwards Air Force Base and Palmdale's Air Force Plant No. 42. Although agriculture (poultry, alfalfa, almond, pear, and peach growing) and mining also make important contributions to the valley's economy, a greater diversification of activity is sought. As stated in the Los Angeles County Planning Commission's 1960 report: "Many industries which might otherwise wish to locate in the Antelope Valley have no doubt been discouraged by lack of a fast four-lane highway running the entire route to the metropolitan area. Completion of the Antelope Valley Freeway should alleviate this problem."

If the boom does develop, the Antelope Valley is expected to grow from its present 74,000 people to over 500,000 by 1980. And by that date, three other new freeways, future Routes 48, 122, and 138, should crisscross the valley, making access easier for motorists and truckers coming from its northwest and northeast corners.

1962 Accident Report

California state highways in 1962 had a slight decrease in total accident rate from 2.76 accidents per million vehicle-miles in 1961 to 2.70 in 1962. A large increase in vehicle-miles of travel coupled with a decrease in number of accidents on urban conventional highways caused the rate reduction in spite of an increase in total number of accidents.

A breakdown of total accidents by highway type is shown in Table I.

The decrease in number of accidents on urban conventional highways results from the 1962 conversion of many miles of old city streets to urban freeways.

The increase in freeway mileage (140 miles rural and 84 miles urban) and its resultant increase in vehicle miles was the basic cause of the increase in number of freeway accidents.

The fatality rate on rural freeways rose substantially from 3.89 per hundred million vehicle-miles in 1961 to 4.88 in 1962. Every type of freeway fatal accident was up in 1962 except cross-median, head-on collisions. The total rural fatality rate dropped slightly from 8.13 in 1961 to 8.06 in 1962. (Freeway fatalities in 1961 and 1962 is the subject of a separate study.)

Table II compares fatalities (number of people killed) in 1961 with 1962 by type of facility. All categories were up except rural conventional. The total killed increased more than the increase in vehicle-miles, causing fatality rates to rise.

The fatality rate on rural conventional state highways (9.10 fatalities per 100 MVM) was almost twice that of rural freeways (4.88/100 MVM) and 3½ times that of urban freeways (2.63/100 MVM). Urban freeways, however, have a higher injury accident rate and total accident rate than rural freeways.

Table III is a comparison of the accident history for 1962 of urban freeways, rural freeways, and other rural state highways. National Safety Council figures for the United States show California freeway fatality rates somewhat higher than the national average for turnpikes.

SYNOPSIS

Total accidents in California in 1962 were up but not as much as vehicle-miles of travel, resulting in a slightly lower total accident rate. Eighty-four miles of urban freeway were opened in 1962, transferring many vehicle-miles of high-accident-rate traffic to the safer freeway.

The fatality rate on rural freeways rose from 3.89 per hundred million vehicle-miles to 4.88. On urban freeways the fatality rate increased from 2.16 to 2.63. Fog accidents, rear-ends, wrong-way drivers, accidents involving drunks, in fact every type of freeway fatal accident was up with the exception of cross-median head-on collisions.

The fatality rate on rural freeways was still approximately one half of the rate on conventional rural highways. Again in 1962, the four-lane undivided conventional highway had the highest accident rate on the rural system.

Fifty percent of the fatal accidents on all freeways were single-vehicle accidents. Three out of five of these hit a fixed object.

Travel now accumulating on lower accident rate rural freeways, annually accounts for approximately 6,000 fewer accidents than the number that would have occured on conventional rural roadways.

Table No. IV lists total accident rates by class of highway on the rural state highway system for the years 1953 through 1962. The 1962 accident rates were very similar to other years. The four-lane undivided class as always (except for 1961) had the highest accident rate. Four-lane divided, two-lane, expressway, and freeway follow in descending order as they have in the past for the predominant classes of highways. The one-lane and the three-lane classifications both have so very few miles, vehicle-miles of travel, and number of accidents that their rates are unreliable and erratic.

The accident rates for both the four-lane undivided and the four-lane divided classes are high for several reasons. One of the main reasons is that they are very often in the urban fringes and should be compared with the higher urban rates rather than rural rates. There generally are more frequent intersections and more roadside developments causing more conflicts with cross traffic, pedestrians, parked and parking vehicles, and egress from and ingress to adjacent improvements.

Table No. V lists the number of accidents, injuries, and fatalities and shows the accident rates by class of highway and severity for 1962. The highest fatality rate for the more common classes of rural state highways was the two-lane section with 10.12 per hundred million vehicle-miles. The rate for the three-lane section, 15.46 for 1962, is subject to considerable variation from year to year because of its total length of only 18 miles. Last year (1961) the same 18 miles had a rate of 8.49.

In 1961 and 1962, a breakdown of fatal accidents on all freeways (urban and rural) in the State, would show the following two-year totals:

Type of accident	*Number (1961+1962)*	*Percent*
Single vehicle	333	50.5
Hit fixed object	204	30.9
Did not hit fixed object	129	19.6
Pedestrian	84	12.7
Walking on freeway	57	8.6
Dismounted vehicle occupant	27	4.1
Head-on collision	104	15.8
Driving wrong way	36	5.5
Crossed median	68	10.3
Overtaking or sideswipe	139	21.0
Rear-end	123	18.6
Sideswipe	16	2.4
Totals	660	100.0

Table VI shows the number of rural accidents, the accident rates for the rural system (conventional highways,

TABLE I

ACCIDENTS BY TYPE OF HIGHWAY

	Number of accidents			*Travel (billion vehicle-miles)*			*Rates (accidents/MVM)*		
Type of highway	*1961*	*1962*	*Percent change*	*1961*	*1962*	*Percent change*	*1961*	*1962*	*Percent change*
Rural freeway	4,212	5,550	+31.8%	3.65	4.56	+25.2%	1.15	1.22	+6.1%
Rural conventional	34,117	35,242	+3.3%	14.19	13.94	−1.8%	2.41	2.53	+5.0%
Subtotal rural	38,329	40,792	+6.4%	17.84	18.50	+3.7%	2.15	2.20	+2.3%
Urban freeway	12,351	15,271	+23.6%	8.07	9.83	+21.8%	1.53	1.55	+1.3%
Urban conventional	44,344	44,229	−5.0%	8.54	8.03	−6.0%	5.19	5.26	+1.3%
Subtotal urban	56,695	57,500	+1.4%	16.61	17.86	+7.5%	3.41	3.22	−5.6%
Grand Total	95,024	98,292	+3.4%	34.45	36.36	+5.5%	2.76	2.70	−2.2%

NOTE: Total accident rate is *down* even though rate of *all* four types of highways is up. This is because the total number of accidents increased only 3.4 percent whereas travel increased 5.5 percent. The reason that accidents increased only 3.4 percent is that travel on the high accident rate systems (conventional) *decreased* 3.3 percent (760 MVM) and travel on the low accident rate systems (freeways) *increasd* 22.8 percent (2,670 MVM).

Put in another way, the overall accident rate represents a weighted average. In 1962, there was more "weight" (i.e. vehicle-miles) to the freeway portion of the total, and even though the freeway *rate* went up, a little, it was much lower than the nonfreeway *rate*, and increasing the weight of the freeway portion thus brought down the overall average.

freeways and total), vehicle miles of rural travel, and miles of rural freeway for the 12-year period of 1951 through 1962.

Table VI shows a slow growth in rural travel after 1955. This is partly due to incorporations during the 1955 to 1962 period which changed the classification of approximately 150 miles of rural highways to urban highways. Generally, these 150 miles of highways are high-volume roads.

TABLE II

FATALITIES BY HIGHWAY TYPE

	Number of fatalities			*Rates (fatalities/100 MVM)*		
Type of highway	*1961*	*1962*	*Percent change*	*1961*	*1962*	*Percent change*
Rural freeway	142	223	+57.0%	3.89	4.88	+25.7%
Rural conventional	1,310	1,269	−3.1%	9.23	9.10	−1.4%
Total rural	1,452	1,492	+2.8%	8.14	8.06	−1.0%
Urban freeway	174	259	+48.9%	2.16	2.63	+21.8%
Urban conventional	237	298	+25.7%	2.78	3.71	+33.5%
Total urban	411	557	+35.5%	2.47	3.12	+26.3%
Grand Total	1,863	2,049	+10.0%	5.41	5.64	+4.3%

TABLE III

1962 ACCIDENTS

	All rural state highways excluding rural freeways	*Rural freeways*	*Urban freeways*
Total number of reported accidents	35,242	5,550	15,271
Number of accidents involving injuries or fatalities	15,589	2,502	6,969
Number of accidents involving fatalities	1,012	186	204
Number of persons killed	1,269	223	259
Number of persons injured (not killed)	26,174	4,142	11,592
Ratio of total reported accidents to number involving injuries or fatalities	2.3	2.2	2.2
Ratio of fatal and injury accidents to fatal accidents	15.4	13.4	34.1
Ratio of total reported accidents to number involving fatalities	34.8	29.8	74.8
Number of reported accidents per fatal	28	25	59
Number of injuries per fatality	21	19	45
Fatality rate per 100 MVM	9.10	4.88	2.63
Fatal and injury accident rate per MVM	1.12	0.55	0.71
Total accident rate per MVM	2.53	1.22	1.55

National Safety Council 1962 U.S. totals are:

Fatalities	41,000
Fatality rate per 100 MVM (all highway types)	5.2
Turnpike fatality rate per 100 MVM	2.6

Freeway Role in Reducing Accidents

During the period 1951-1952, approximately 650 miles of rural freeways were opened to traffic. Total accidents have increased only 7.6 percent, whereas travel has increased 32.1 percent. This is reflected in a 19 percent reduction in the rural accident rate from 2.71 in 1951 to 2.20 in 1962. It can be said that the rural freeways have prevented a substantial increase in the number of accidents in spite of a one-third increase in the amount of travel on the rural system. This is demonstrated by Table VII, which shows the probable number of accidents that were avoided each year owing to the travel taking place on rural freeways instead of conventional highways. In the 12-year study period, over 37,000 accidents were avoided because a substantial part of the rural travel was on freeways in lieu of conventional highways.

Except for the years 1961 and 1962, there has been a downward trend in the accident rate for rural conventional roads. One of the prime reasons for the decrease in rate is that those rural sections of highways with the greatest amount of traffic and worse accident rates have generally been replaced by freeways first. Therefore, if the more than 660 miles of rural freeways had not been constructed, the rural conventional highway accident

rate might have increased instead of decreased in the past decade. A conservative estimate is that the number of accidents avoided by the rural freeway system since 1951 is in the order of 87,000. (87,000 is arrived by applying the 1951 accident rate of 2.77 to the 12-year accumulation of 201 billion vehicle-miles = 557,000 accidents. Subtracting actual number of accidents (470,000), leaves the 87,000 savings.)

Similar long-range data is not available for the urban system since accident reports on conventional urban state highways were not received by the Traffic Department prior to 1961.

However, because of the enormous amount of travel on urban freeways, the results are even more impressive for urban freeways, although the recorded history is shorter. It is estimated from the difference in the accident rates of city streets and urban freeways that if the 9.83 billion vehicle-miles of travel on urban freeways in 1962 had occurred on city streets, 35,000 more accidents would have occurred on the urban system in 1962 alone.

It is estimated that the freeway system (rural and urban) completed as of the end of 1962 has saved over 2,000 lives in the 14-year period of 1949 through 1962.

TABLE IV

ACCIDENT RATES ON VARIOUS CLASSES OF RURAL STATE HIGHWAYS
(Number of Accidents per Million Vehicle-miles)

Year	1-lane	2-lane	3-lane	4 or more lanes undivided	4 or more lanes divided	Divided expressway	Freeway	Total
1953	(a)	2.16	2.85	3.55	3.05	1.86*	(a)	2.35
1954	(a)	2.21	2.65	3.54	3.11	1.71*	(a)	2.30
1955	(a)	2.28	2.82	4.38	3.21	1.76*	(a)	2.41
1956	(a)	2.40	3.07	4.61	3.37	1.96	1.22	2.49
1957	(a)	2.44	3.04	4.35	3.07	1.85	1.05	2.36
1958	(a)	2.45	3.03	4.13	3.08	1.77	0.98	2.26
1959	(a)	2.38	2.57	4.09	2.91	1.70	1.00	2.15
1960	(a)	2.29	2.49	4.03	3.05	1.65	1.21	2.12
1961	2.95	2.42	4.80	4.13	3.06	1.71	1.15	2.15
1962	3.67	2.55	3.88	4.62	3.06	1.86	1.22	2.20

(a) Not available.
* Includes freeways.

TABLE V

ACCIDENTS AND ACCIDENT RATES ON VARIOUS CLASSES OF RURAL STATE HIGHWAY BY KIND OF ACCIDENT
(CALIFORNIA 1962)

	2-lane (a)		3-lane		4 lanes undivided (b)		4 lanes divided (c)		Divided expressway		Freeway		Total	
Miles	10,581		18		138		222		759		664		12,382	
Million vehicle-miles	8,150		71		771		1176		3,771		4,566		18,505	
Average daily traffic	2,110		10,800		15,400		14,500		13,700		18,700		4,100	
	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Total reported accidents	20,793	2.55	275	3.88	3,562	4.62	3,601	3.06	7,011	1.86	5,550	1.22	40,792	2.20
Fatal and injury accidents	9,335	1.15	124	1.75	1,431	1.85	1,447	1.23	3,252	0.86	2,502	0.55	18,091	0.98
Injuries	15,457		195		2,345		2,427		5,748		4,144		30,316	
Vehicle occupants	15,254		190		2,248		2,364		5,708		4,108		29,872	
Pedestrians or cyclists	203		5		97		63		40		36		444	
Fatalities	825	10.12	11	15.46	65	8.43	83	7.06	285	7.56	223	4.88	1,492	8.06
Vehicle occupants	765		11		58		64		262		193		1,353	
Pedestrians or cyclists	60		0		7		19		23		30		139	

Rates shown are accidents per million vehicle-miles except fatalities rates are persons killed per 100 million vehicle miles.
(a) Includes 182 miles of one lane.
(b) Includes 29 miles of six lanes undivided.
(c) Includes 73 miles of six lanes divided.

TABLE VI

Year	Rural accidents	Rural accident rates			Rural travel (billion VM)	Miles rural fwys.
		Conv.	Fwy.	Combined		
1951	37,927	2.77	1.51 *	2.71	14.02	50 *
1952	40,462	2.78	1.56 *	2.70	14.99	61 *
1953	37,292	2.44	1.39 *	2.35	15.88	82 *
1954	37,068	2.45	1.27 *	2.30	16.10	131 *
1955	41,315	2.66	1.24	2.41	17.15	109
1956	42,828	2.60	1.22	2.49	17.19	181
1957	40,252	2.53	1.05	2.36	17.06	274
1958	38,285	2.48	0.98	2.26	16.97	371
1959	37,640	2.39	1.00	2.15	17.52	430
1960	38,138	2.31	1.21	2.12	18.01	448
1961	38,329	2.42	1.15	2.15	17.84	524
1962	40,792	2.53	1.22	2.20	18.51	664

* Rural plus urban.

Accident Reporting From Cities

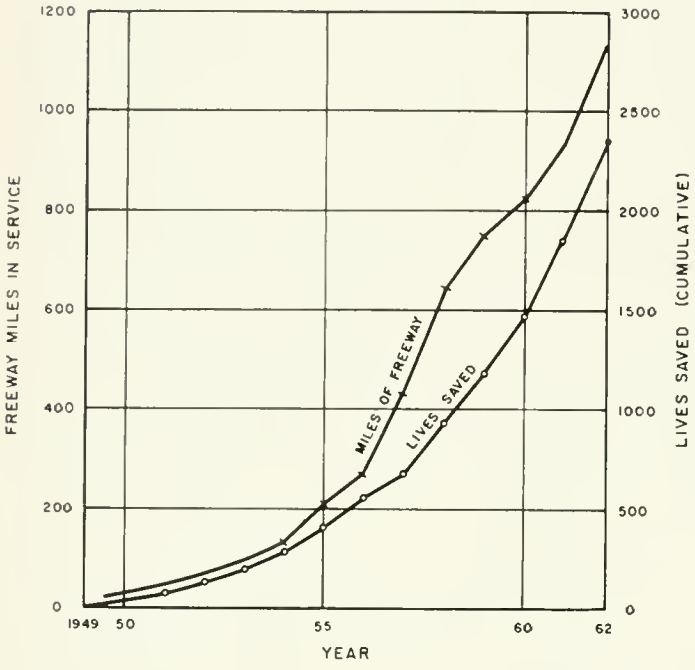
1961 and 1962 were the first two years that we received accident reports on the state highways on urban city streets. They were not coded in detail for 1961 and 1962, merely counted. In 1963, we are coding urban conventional highway accidents.

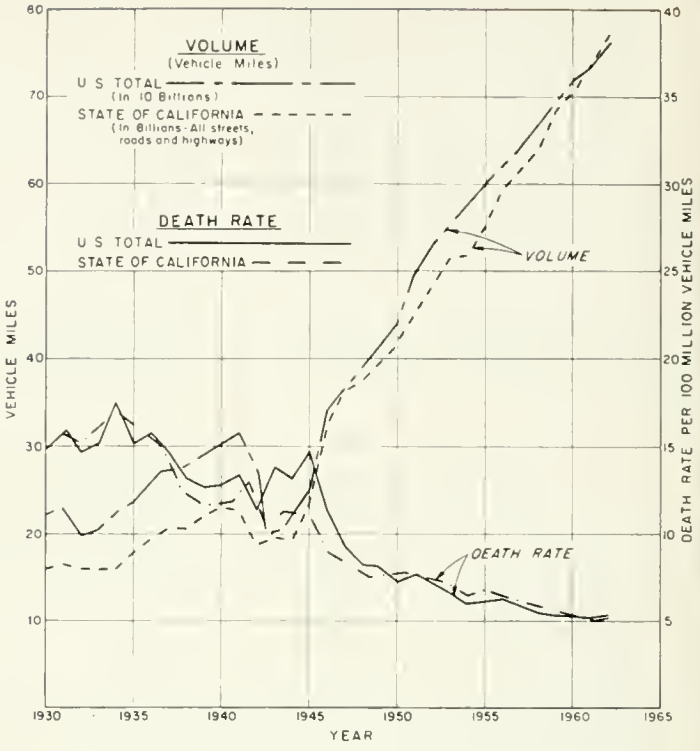
Approximately 270 cities out of 384 in the State are submitting reports on city streets that are state highways. Since most of the cities not reporting

Figure 1

CALIFORNIA FREEWAYS

ESTIMATED NUMBER OF LIVES SAVED BY FREEWAYS IN OPERATION SINCE JAN. 1, 1949





CALIFORNIA VS U.S TOTAL

FIGURE 2

1962

TOTAL DEATHS BY AGE GROUP

United States Total x 1,000

California Total x 100

(All streets and roads)

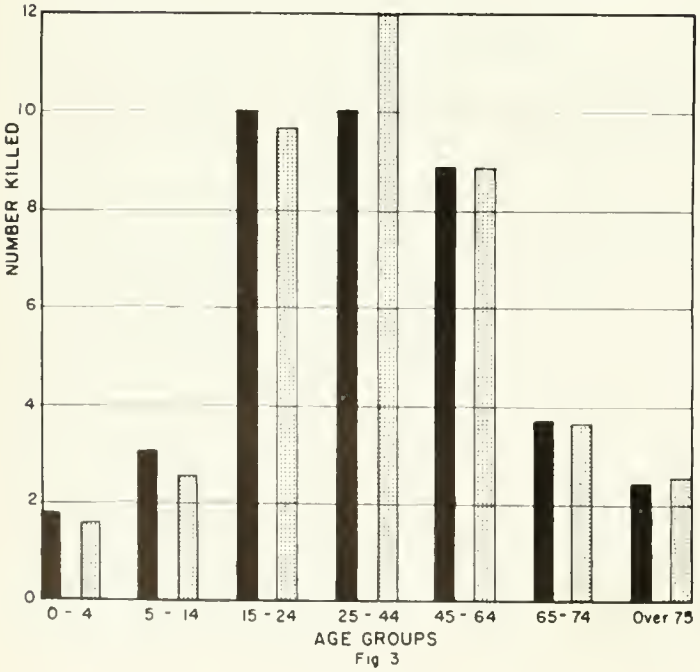
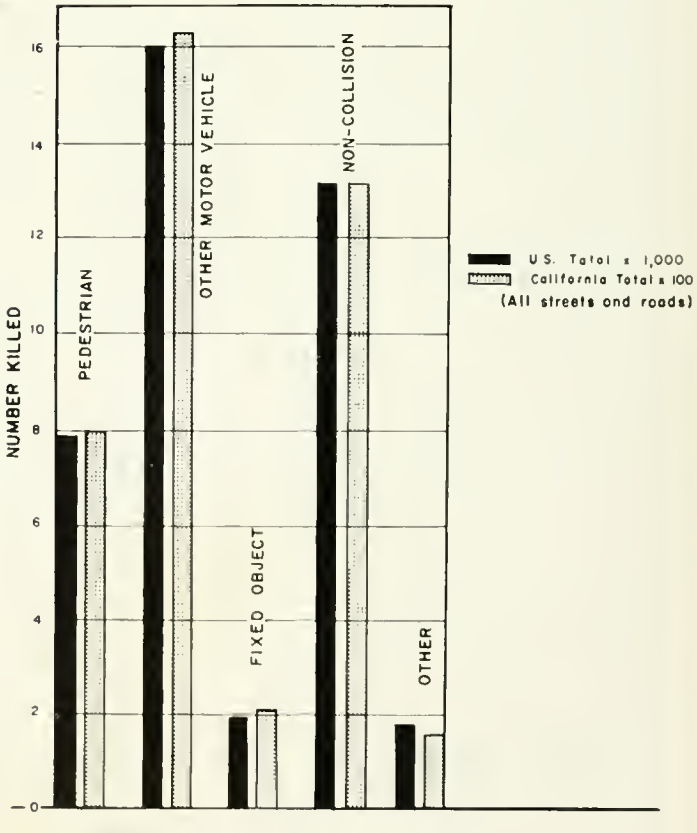


Fig 3



1962 DEATHS BY TYPE OF ACCIDENT

FIG. 4

TABLE VII

PROBABLE NUMBER OF ACCIDENTS AVOIDED BY RURAL FREEWAY SYSTEM

Year	*Rural travel (billion VM)*	*Accident rate (rural conv.)*	*Probable number of accidents w/o freeways*	*Number of accidents that actually occurred*	*Number of accidents avoided*
1951	14.02	2.77	38,835	37,927	908
1952	14.99	2.78	41,672	40,462	1,210
1953	15.88	2.44	38,747	37,292	1,455
1954	16.10	2.45	39,445	37,068	2,377
1955	17.15	2.66	45,619	41,315	4,304
1956	17.19	2.60	44,694	42,828	1,866
1957	17.06	2.53	43,162	40,252	2,910
1958	16.97	2.48	42,086	38,285	3,801
1959	17.52	2.39	41,873	37,640	4,233
1960	18.01	2.31	41,603	38,138	3,465
1961	17.84	2.42	43,173	38,329	4,844
1962	18.51	2.53	46,830	40,792	6,038
Total	201.24		507,739	470,328	37,411

are small, we believe we are receiving over 90 percent of all the acident reports.

Figure No. 2 shows a death rate and travel volume comparison between California and the United States as a whole. The volume curves of California and the United States are very similar with respect to rate of increase. For the first time, in 1962, California exceeded 10 percent of the nation's total travel in vehicle-miles. California's death rate for all motor vehicles involving deaths remains about the same as for the United States.

Figure No. 3 compares California with the nation in ages of all victims killed in motor vehicle accidents. California deaths are very nearly 10 percent of the nation's total. Deaths in the various age groups for California parallels closely the national averages.

Figure No. 4, Deaths by Type of Accident, shows California, for all types of roadways, again following the national trend. Figure No. 4 illustrates also that pedestrian deaths were about half those caused by collisions between automobiles. For the entire street and highway network, deaths by collision with a fixed object were only 15 percent of the total single vehicle accident deaths. On freeways this type of accident causes 30.9 percent of all the deaths, and 60 percent of the single vehicle accident deaths. This does not necessarily mean that the freeway fixed object accident rate is high. The fixed object fatal accident category is a higher percentage of the total on freeways. The head-on and intersection accidents, which are a large portion of the total accident picture on conventional roads, have been virtually eliminated on freeways.

DIVISION HAS ONE-SEVENTH OF TOTAL ITTE ALUMNI

A recent almuni roster of the Institute of Transportation and Traffic Engineering indicates that 14 percent of the total—or 17 alumni—are now with the California Division of Highways. Each of these men has a degree of M.E., M.S., or D.E. in transportation engineering.

District IV employs Associate Highway Engineer Maurice W. Beckstead, Disrrict Planning Engineer Burton N. Crowell, Assistant Highway Engineer Hiroshi Eta, Associate Highway Engineer Donald K. Goodrich, District Planning Engineer Dean E. Larson, Associate Highway Engineer James W. Rae, Assistant District Engineer A. E. Simmons, and Project Engineer Frank C. Tedesco.

Headquarters has three of the ITTE graduates: Assistant Maintenance Engineer Carlton E. Forbes, and Senior Highway Engineers Max D. Rothe and Charles E. Zell, both in urban planning.

Employed in other areas are Assistant District Engineers Allison D. Mayfield and William E. Shaefer of District VII; Senior Highway Engineer Leigh Ballard of District XI, Associate Highway Engineer George O. Bischof of District II, Associate Highway Engineer Edward W. Blackmer of District III, and Assistant Highway Engineer John W. Lund of District IX.

ITTE was established by the Legislature in 1947, and organized at the University of California, Los Angeles, with this mandate: to "carry on instruction and research related to the design, construction, operation, and maintenance of highways, airports, and related facilities for public transportation."

Functioning as a part of the university, ITTE's primary objective is education and advancement of knowledge in the transportation and traffic engineering fields, through training of a graduate and professional type, various phases of in-service training, and dissemination of factual information to public agencies and groups other than those composed of technical engineers.

An annual street and highway conference is sponsored by ITTE, bringing together state, city and county engineers and others interested in transportation—such as representatives of consulting firms, material suppliers, automobile associations and transit organizations. The 16th conference was held this year on the Berkeley campus of the university, January 30, 31 and February 1.

In its *Quarterly Bulletin*, ITTE regularly reviews current activities and research projects, and lists ITTE publications available.

Harmer E. Davis has been ITTE director since its establishment.

Time-Distance Study

1937, 1963 Compared; Predictions for 1980

By J. P. SINCLAIR, Assistant State Highway Engineer

A recent study, made by the District IV Traffic Department during nonpeak travel hours, reveals that as a result of freeway construction it is now possible to travel twice (and in several instances three times) as far as it was in 1937—moving in the same direction and using the same amount of time.

This study was based upon WPA Project 5577, a survey of average vehicular speeds over selected main streets in the Oakland and San Francisco Metropolitan Areas made in 1937 by the Oakland Street Department.

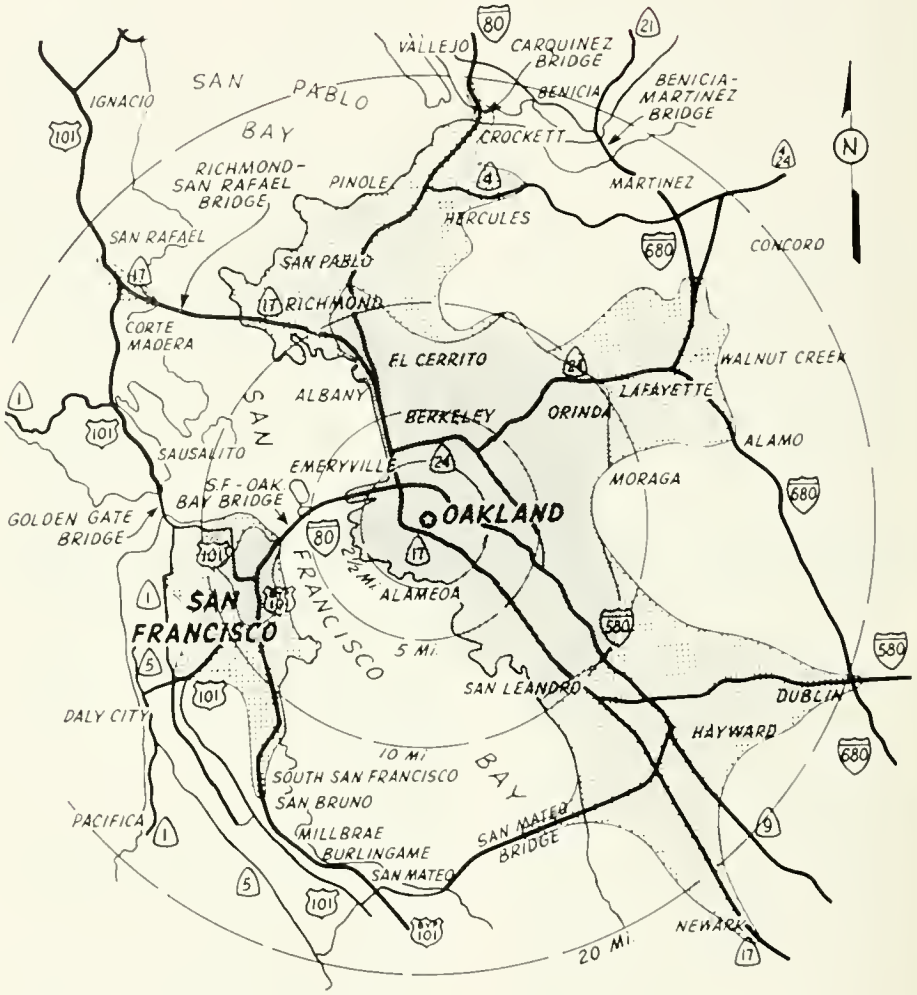
In 1937, there were 590,000 motor vehicles registered in the nine counties of the San Francisco Bay area, which had a population of about 1,680,000, and, of course, no freeways. Today's population is 4,000,000 with 1,650,000 vehicles using a freeway network of over 380 miles.

The Oakland point of origin of the 1937 study was 14th and Broadway. It took 20 minutes to reach the intersection of San Pablo and Solano Avenues in Albany, a distance of 6.0 air miles. It took the same amount of time to reach the Alameda–Contra Costa county line through the old Broadway high-level tunnel, only 4.8 miles from the starting point. The intersection of 107th Avenue and East 14th Street, a distance of 7.5 miles, was reached in 25 minutes.

Current Study

The current study reveals that it is now possible to travel 12.4 instead of 6.0 miles in the same 20 minutes from the same starting point in Oakland and arrive at the intersection of San Pablo Avenue and Road 20 in San Pablo.

In 1963 the test driver covered 8.9 instead of 4.8 miles in 20 minutes and arrived at the intersection of the Free-



LEGEND

- *Origin (14th St. & Broadway, Oakland)*
- *Concentric mile circles with zero at origin*
- *30 minute distance from origin—1937*
- *30 minute distance from origin—1963 (Not peak hours)*

EAST BAY METROPOLITAN AREA MOTOR VEHICLE TRAVEL TIME

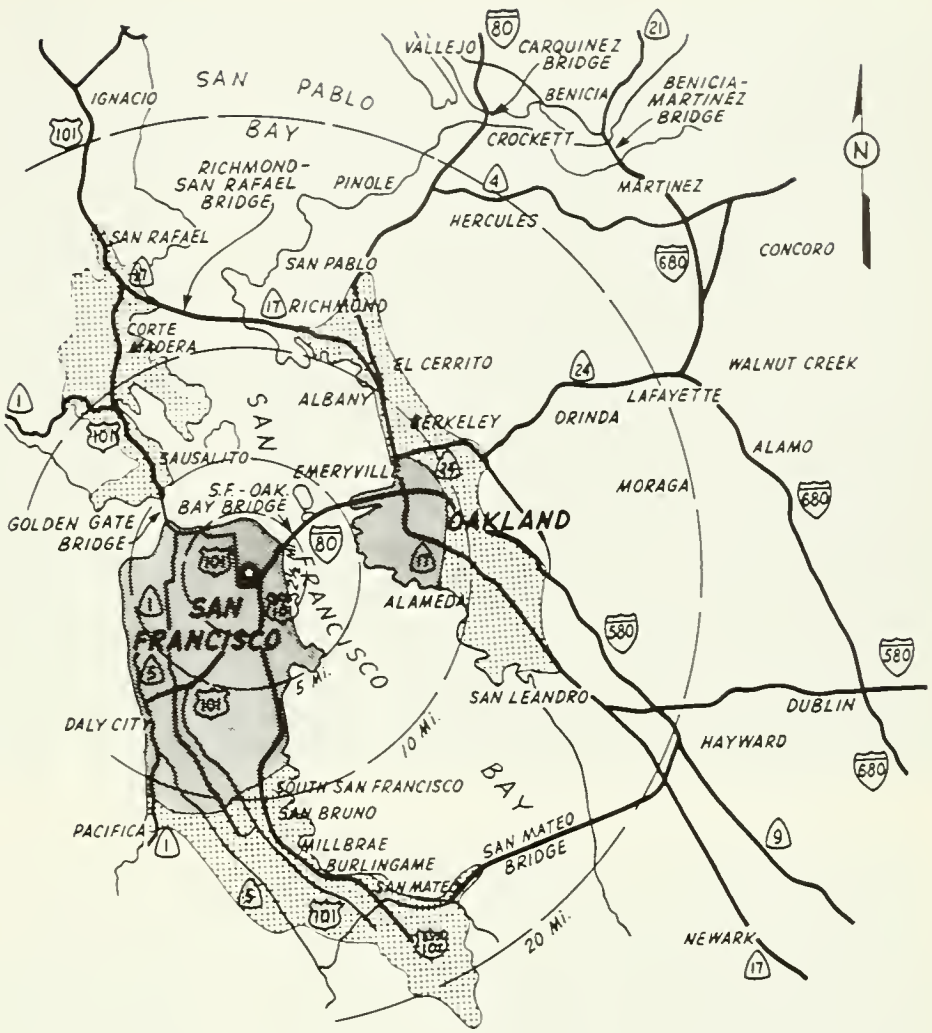
Scale

0 1 2 3 4 5 6 7 8 MILES

way and Upper Happy Valley Road in Lafayette. Where it took 25 minutes to go 7.5 miles in 1937, the test driver went 18 miles in the same direction in the same time in 1963 to the intersection of Nimitz Freeway and Alquire Road in Hayward.

The starting point in San Francisco was at Fulton and Larkin Streets. In 1937 it took 25 minutes to go 6.5 air miles to Mission Street at the San Mateo county line. The intersection of 19th Avenue and Sloat Boulevard, 5.7 miles from the point of origin, was reached in 20 minutes. It took 15 minutes to go 4.8 miles to the intersection of Third Street and Bayshore Boulevard.

Starting from San Francisco, the test driver in 1963 went 12.6 instead of 6.5 miles to the intersection of Sneath Lane and Junipero Serra Boulevard in San Bruno; 8.4 instead of 5.7 miles to the junction of Eastmoor Avenue and Junipero Serra Boulevard in Daly City; and 15.4 instead of 4.8 miles to the point where the Bayshore Freeway joins Peninsula Avenue in San Mateo—in each instance using the same amount of time it took in 1937.



LEGEND

- Origin (Fulton & Larkin Sts., S.F.)
- Concentric mile circles with zero at origin
- 30 minute distance from origin — 1937
- 30 minute distance from origin — 1963 (Not peak hours)

SAN FRANCISCO METROPOLITAN AREA MOTOR VEHICLE TRAVEL TIME

Scale 0 1 2 3 4 5 6 7 8 MILES

Depression Year Traffic

One major factor holding down the volume of traffic in 1937 was the nationwide depression, which was still very much in evidence; although the construction of the two magnificent bridges — the San Francisco-Oakland Bay Bridge and the Golden Gate Bridge—helped make its effects felt less in the San Francisco Bay area than elsewhere in the country.

The only resemblance to an expressway in the State of California at that time—the Arroyo Seco Parkway—was in the early planning stage.

It was not until 1939 that the Legislature established the freeway principle by statute and authorized the Department of Public Works to construct any portion of the State highway system as a freeway or to make any existing State highway a freeway.

Senate Concurrent Resolution No. 26, adopted by the Legislature at the 1957 session, requested the Department of Public Works "to undertake a study which will provide a basis for an overall statewide plan of freeways and expressways for the State of California, such study not to be limited to state highways, and to locate the potential freeway and expressway routes of such a statewide system and the necessary connections thereto as nearly as is practicable in advance of detailed engineering design of project."

Master Plan Adopted

As a direct result of this study, the 1959 Legislature adopted a master plan

PHOTO ABOVE. Mount Diablo Boulevard (above) crowded with traffic heading east in Contra Costa County toward the Pleasant Hill Road intersection beyond the crest of the hill. The year: 1953. PHOTO BELOW. Construction on the Sign Route 24 freeway which parallels Mount Diablo Boulevard (right).

PHOTO ABOVE. San Pablo Dam Road extends up from the bottom of the photo to intersect with San Pablo Avenue (center). Right-of-way for future Interstate 80 freeway is being cleared in the area to the left of the drive-in movie. The year is 1954. PHOTO BELOW. The Eastshore Freeway (Interstate 80) takes traffic through Richmond in western Contra Costa County. Relocated San Pablo Dam Road crosses the freeway (foreground). Note the location of the drive-in movie in this and the above photo.

for the California freeway and expressway system, to be essentially complete by 1980.

Since that time the California freeway and expressway system construction has been carried on in full swing in accordance with the master plan.

At present, the District IV (San Francisco Bay area) portion of the master plan is approximately 30 percent complete. As of October 1, 1963, there were some 384 miles of freeway and expressway completed, under construction, or budgeted for to serve the 1,650,000 registered motor vehicles and the 4,022,000 inhabitants of the nine counties comprising District IV.

Just as in the rest of California, however, the freeway and expressway system in the Bay area is by no means complete.

It is planned that by 1980 there will be about 1,250 miles of freeway and expressway in District IV to carry an estimated 6,500,000 inhabitants in some 3,200,000 motor vehicles.

Freeway Median Used For Transit Line

Acquisition of rights-of-way for the joint highway-rail use of a portion of the Grove-Shafter Freeway in Oakland is now in progress, along with some redesign of the project, on the basis of a "share the cost" agreement between the State and the Bay Area Rapid Transit District.

The agreement was signed by Director of Public Works John Erreca on December 3, 1963, after extensive discussions between representatives of the State Division of Highways and the BARTD. It covers the section of freeway between 24th Street and Golden Gate Avenue, a length of about 3½ miles.

Rapid transit facilities will occupy a portion of the median strip between the roadways of the freeway, according to the agreement. Costs for right-of-way and common construction facilities will be shared in proportion to the areas occupied by each agency.

The agreement will make possible not only substantial savings but also considerably less disruption to the community than if the facilities were separately located, designed and built.

BEFORE FREEWAY. Heavy traffic on Bayshore Boulevard, going north from the Peninsula, stops at traffic light at Third Street in San Francisco. The year: 1953.

AFTER FREEWAY. The Bayshore Freeway and Third Street Overcrossing (center) after the freeway was completed in 1957.

South Bay Freeway

By A. S. HAMM, Resident Engineer

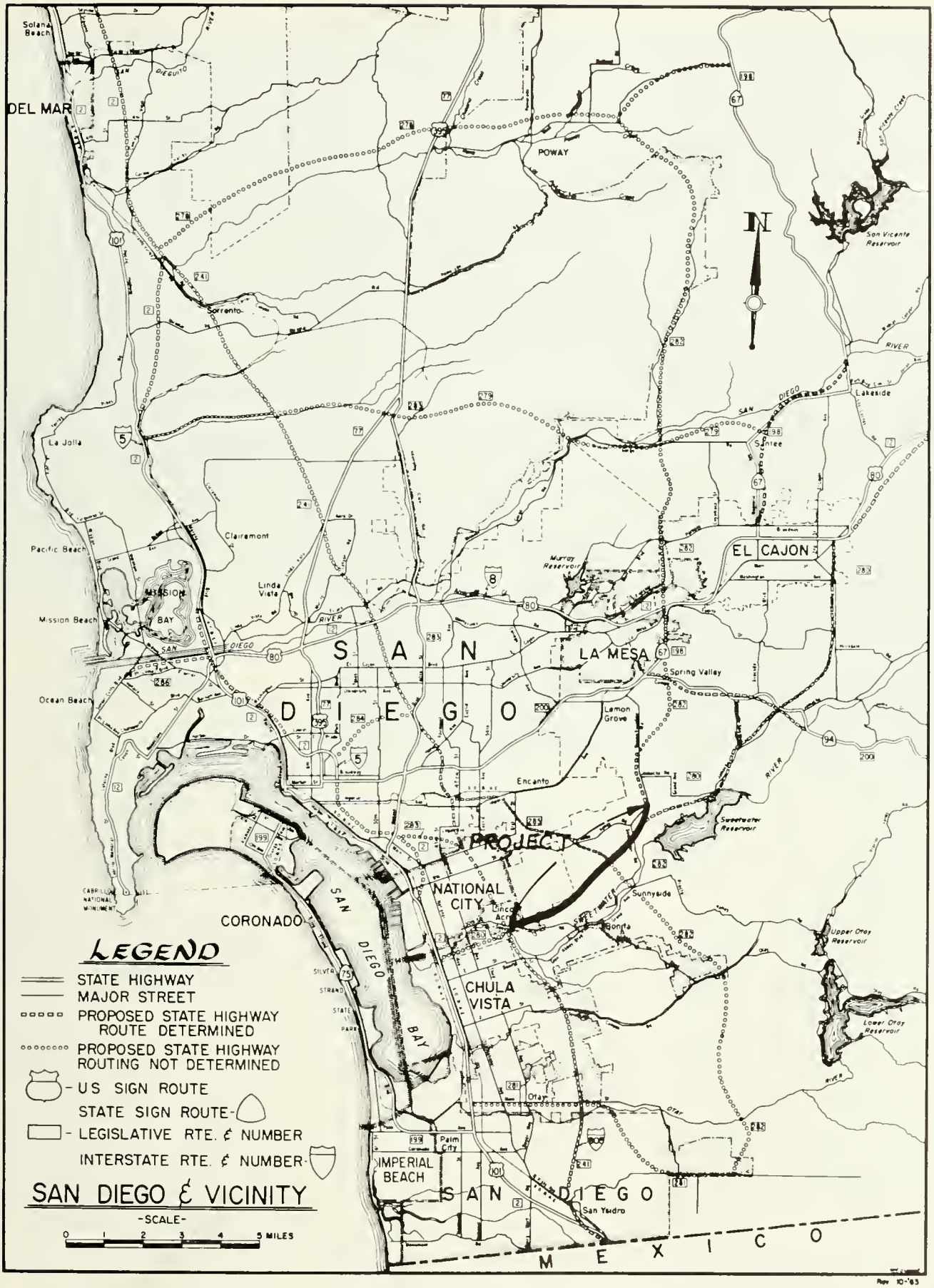
In the early afternoon of September 27, 1963, county, state and contractor personnel removed construction barricades and opened to traffic a 4¾-mile link in the South Bay Freeway. Inside of 10 minutes traffic was moving rapidly both ways between the National City—Chula Vista area and the Spring Valley area southeast of San Diego. The new freeway allows through traffic to bypass about six miles of two-lane Sweetwater Road, which meanders through the Sweetwater Valley in the Bonita area.

During commuter hours, traffic had been extremely congested and hazardous on the old route. Now the remaining local traffic can move smoothly and with improved speed on the old road, while through traffic moves swiftly and safely on the new route.

This road was the culmination of studies begun early in the last decade by the county on a proposed federal aid secondary project to run directly from Sweetwater Road at National City northeasterly to Spring Valley where Sweetwater Road joins Jamacha Boulevard. The route was settled upon in 1956. However, budget problems, traffic loads and rising land values demonstrated that the type of propect planned had become, by 1959, uneconomical and wasteful because it would be abandoned when contemplated state freeways were constructed.

Therefore, Mr. D. K. Speer, county surveyor and road commissioner proposed that this county project become the construction of the initial four lanes of an ultimate eight-lane divided freeway, initially known as Legislative Route 280 of the State Division of Highways freeway and expressway system in San Diego County. Under

Looking northeost from Sweetwater Road crossing toward reentry into Sweetwater Road at the northeost end of the project. Both large rock cuts show clearly.


DEL MAR
POWAY
N
La Jolla
Clairemont
Pacific Beach
Mission Beach
Ocean Beach
MISSION BAY
Linda Vista
SAN DIEGO
LA MESA
EL CAJON
Spring Valley
Lemon Grove
Encanto
Lakeside
Santee
Sorrento
Murray Reservoir
San Vicente Reservoir
Sweetwater Reservoir
Upper Otay Reservoir
Lower Otay Reservoir
PROJECT
NATIONAL CITY
Sunnyside
Bonita
CHULA VISTA
Otay
Palm City
IMPERIAL BEACH
CORONADO
SAN DIEGO BAY
SAN DIEGO
San Ysidro
MEXICO
LEGEND
STATE HIGHWAY
MAJOR STREET
PROPOSED STATE HIGHWAY ROUTE DETERMINED
PROPOSED STATE HIGHWAY ROUTING NOT DETERMINED
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0 1 2 3 4 5 MILES

Looking northeost from Sweetwater Rood ot the Notionol City end of the project. Photo on following page continues view of the freeway storting with section visible in far distance of above aeriol.

the new numbering system, which becomes operative on July 1, 1964, it is designated as Route 54.

Superior Standards

The superior freeway standards for grades, alignment and right-of-way would necessitate expenditures beyond those for the original F.A.S. project, and in excess of county funds available for right-of-way. An agreement was worked out whereby in advance of county construction the State Highway Commission adopted the route and the Division of Highways paid for the additional right-of-way and access rights required to accommodate adopted future state construction.

This F.A.S. project is a splendid example of the savings to, and better highways for, the motoring public that can be accomplished by close cooperation and understanding between such governmental agencies as the California Division of Highways and the County of San Diego. The eventual saving in right-of-way costs to the Division undoubtedly will exceed $3,000,000 even disregarding the benefit derived from the construction of one-half of the ultimate freeway. This saving is based upon the difference between the cost of purchasing the presently undeveloped land and the estimated cost of the same land 10 years in the future after it has become fully developed.

Original Plans

The original plans called for grading four lanes and paving two lanes on one-half of the final eight-lane development. Evaluation of traffic and cost factors warranted paving four lanes in the initial contract. The decision has proved sound; for, only two months after completion, the daily count was 12,000 cars per day on the old and new roads—a 4,000-car increase from the old road volume. The horizon year estimate is for 112,000 cars per day, which would require the anticipated eight-lane freeway.

In accordance with the master plan of highways for San Diego County, this facility was engineered to become an integral connecting link with five freeways being planned for this area in the next 20 years. This freeway system is particularly important in the light of prospective port and industrial facilities in the South Bay area.

The new road is 62 feet in paved width between outer edges of shoulders. It provides two 11-foot lanes and a 7-foot shoulder on each side of a 4-foot-wide painted median strip. Designed to freeway standards, grades are easy and curves are flat, making the road pleasant to drive at maximum legal speeds throughout. Four-foot earth shoulders lie outside the paved shoulders. Normal cross slope is 5 percent on the shoulders, and is 2 percent to the right on all four traffic lanes. This is because all four lanes will carry traffic in the same direction when the State duplicates the roadway on the left in the future.

Structural Section

The structural section consists of a 1-foot subbase, an 8-inch base and a 3-inch asphalt concrete pavement in the central 48 feet. The two 7-foot shoulders consist of a 9-inch subbase, a 4-inch base and a 1½-inch asphalt concrete pavement. The base and subbase as supplied were of much better quality than the specified minimum. The class 2 aggregate subbase stabilometer value was 78 and the sand equivalent value was 51 against specified minimum values of 60 and 25 respectively. The class 2 aggregate base stabilometer value was 81 and the sand equivalent value was 54, compared with specified minimum values of 78 and 30 respectively.

Excepting a three-barrel concrete culvert, all drainage structures are of galvanized corrugated metal pipe,

View from near middle of the project to northeast end of the highway in the far left background. The heavy, sandy cuts can be clearly seen. The wide, white strip on the left of the roadway is close to 70,000 cubic yards of waste material placed for future four-lane addition.

asphalt coated where prior tests indicated corrosive, "hot" soil. All drainage structures were planned to become an integral part of the ultimate project.

For about two-thirds of the project length, the underlying natural soil was a prehistoric material of gray to white beach sand and fines containing a good percentage of rounded, hard, polished rock up to six or eight inches in diameter. The material was weak when saturated, but had good stabilometer and sand equivalent values. It was not inherently difficult to handle or compact in the fills. This natural ground stood well in deep cut banks, some up to 70 or 80 feet high.

Deep Cuts, High Fills

The northeast third of the project contained deep cuts and high fills. The cuts yielded a high percentage of sound quartizitelike rock and larger quantities of mudstone. Both kinds of stone required much shooting, but the mudstone broke down well and slaked to a high degree when wet so that good, tight, stable fills resulted. All excess cut, of about 100,000 cubic yards, was placed in the right-of-way on the left where it would economically provide fill for the coming construction in another decade.

As previously mentioned, the new four-lane facility will be converted into an eight-lane freeway when the State builds, in a few years, a median and four additional lanes along the northwest (left) side of the existing. Prompted by swiftly rising land values, which would add in excess of $3,000,000 cost in 10 years, the State and county have provided liberal right-of-way for the future construction. This explains the fact that right-of-way costs exceeded the amount of the construction contract.

New Construction Warranted

Traffic studies warrant much new construcrion by the State and county in the area southeast of San Diego. As this and other high-speed links are added, the need for rapid program completion will certainly grow more pressing. Already this new section is accentuating the obsolescence of streets joining this new link on the southwest Montgomery Freeway and to Highway 94 and Highway 80 (Interstate 8) on the northeast. Therefore, plans are already made for extension of the South Bay Freeway as fast as funds allow.

A breakdown of costs for this federal aid secondary project follows:

Contract construction cost	$1,159,805
Federal aid contract funds	45%
State-county contract funds	55%

Item	*Amount*	*Percent contract construction*
Total preliminary and design engineering	$74,000	6.4
Total construction engineering (county and state)	164,000	14.2
Right-of-way—State	421,238	36.3
Right-of-way—county	795,426	68.6
Totals	$1,454,664	125.5
Total cost of contract, engineering, and right-of-way		$2,614,470

Site and soils investigation was handled by District XI of the California Division of Highways under direction of Paul Ruplinger.

Project design was under immediate supervision of Richard D. Dudley of the County of San Diego. Project design review was under the direction of John Rising of District XI.

Project construction resident engineers were Richard D. Dudley and Alton S. Hamm for the county; state project construction representatives were James V. Bell and Henry Chisholm, with Eugene Calman acting for the State as district construction engineer. Contractor was Daley Corporation of San Diego; contractor's superintendent was Robert Conley.

MICKLE NAMED DIRECTOR

The National Academy of Sciences–National Research Council has announced the appointment of D. Grant Mickle as executive director of its highway research board.

Mickle, who has been deputy federal highway administrator for the past two years, succeeds Fred Burggraf, who will retire as director following the 43d annual meeting of the board in January. Burggraf, the director since 1951, will continue to serve the board as consultant.

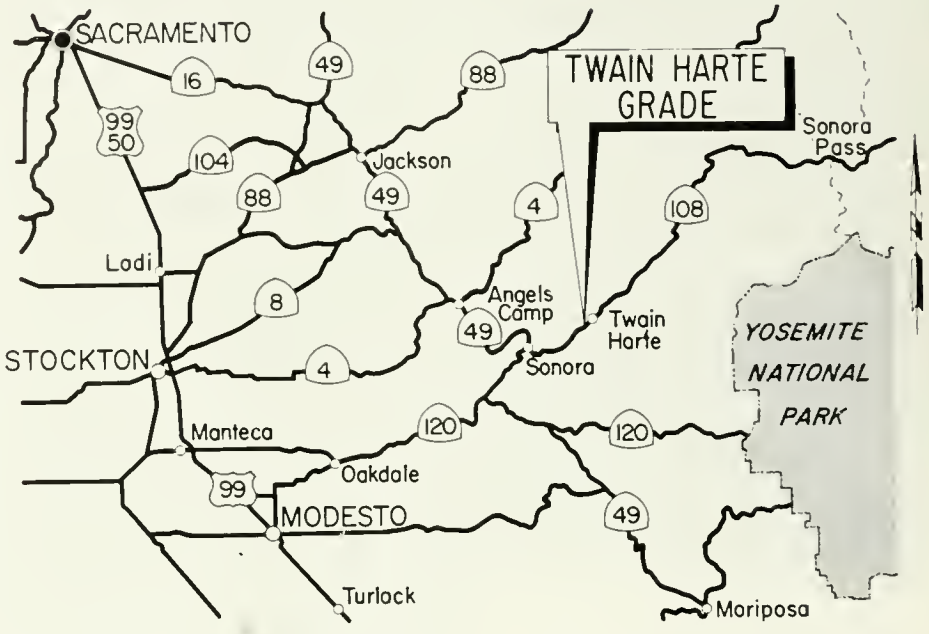
W. N. Carey, Jr., assistant director of the board, will become deputy executive director.

Twain Harte Grade

Modern, Scenic Freeway Was Construction Goal

By C. E. MOFFATT, District Design Engineer

To build a scenic highway in a mountain recreation area and make it a modern freeway at the same time – this was the challenging assignment and opportunity that has resulted in the recently completed "Twain Harte Grade" project on State Sign Route 108, in Tuolumne County, east of Sonora. How this opportunity was grasped and the goals realized is a revealing account of the highway engineer's recognition of the aesthetic and scenic values along the route, and the means by which the location was adjusted and the design was made to preserve these desirable values.



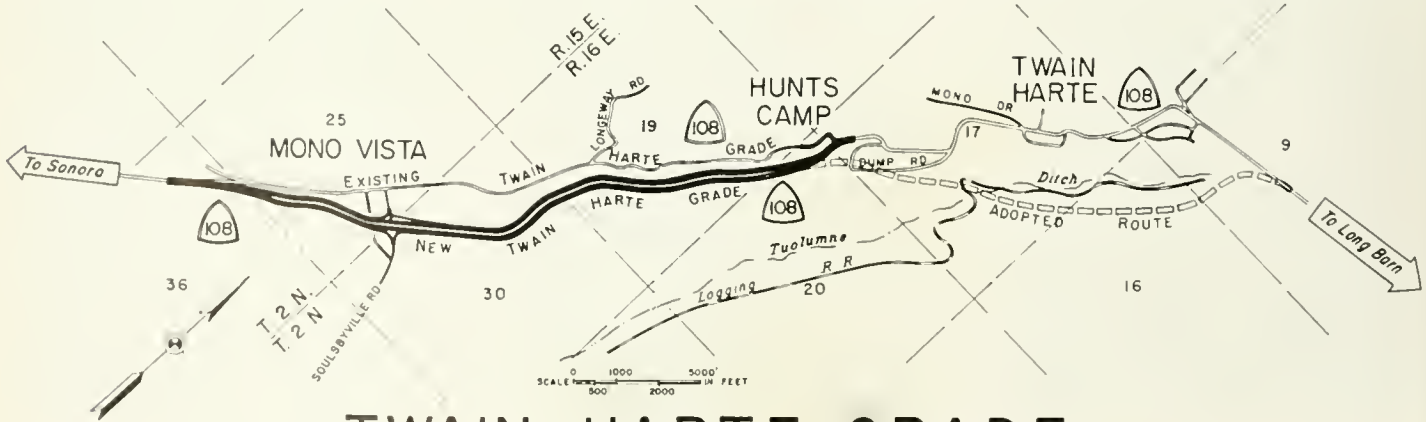
Highway 108 (Legislative Route 13) serves a rapidly growing recreational area of the Sierra Nevada from the City of Sonora to Sonora Pass and the eastern slope of the Sierra, passing through the mountain communities of Twain Harte, Sugar Pine, Mi-Wuk Village, Long Barn, and Pinecrest—to name a few.

The total summer population of the area between Twain Harte and Pinecrest is estimated to be nearly 20,000, consisting of those in houses and cabins, various camps sponsored by municipal, fraternal, religious, and college alumni groups, Boy Scouts, Girl Scouts, and individual campers.

New Subdivisions

In the last year, there have been 29 new subdivisions started in Tuolumne County, 23 of which have been on or near Sign Route 108, east of Sonora. In addition to the homes being built in these subdivisions and on other pieces of land, there are many commercial buildings, motels, and other establishments being constructed to serve the needs of the summer and winter residents and visitors.

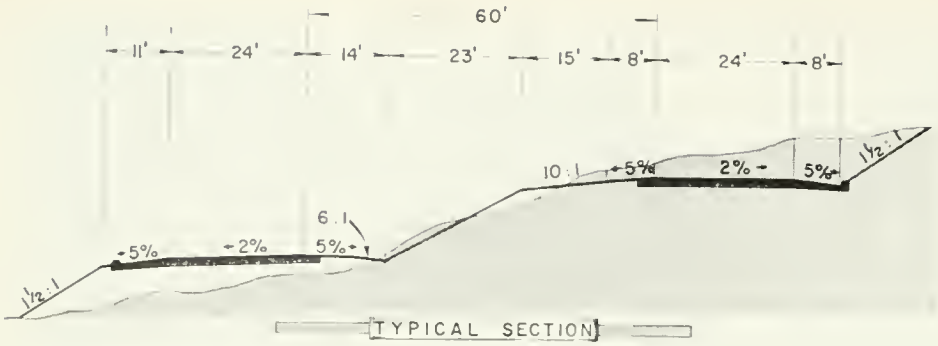
Until the last few years, summer vacationing was the most important attraction in this area, but, since the winter snow sports are becoming more and more popular, the winter travel on this road is now comparable to the summer traffic. In addition to serving the needs of people traveling from the valley and bay areas, this highway will



TWAIN HARTE GRADE

THE OLD. A queue of cars near Hunts Camp at the top of the old Twain Harte Grade

THE NEW. An uphill view showing the new highway fitted to the sidehill above the old road.



SIDEHILL CONSTRUCTION

continue to handle a substantial amount of local traffic in and around the growing local communities, including logging trucks and other commercial traffic.

The development of this area was greatly accelerated during the postwar boom in travel and recreation, and it was soon evident that a major improvement of Highway 108 was needed to handle the traffic volumes that would be generated. Consequently, studies that had begun earlier were updated and tailored to meet the trend. Additionally, the road was included in the California freeway and expressway system in 1959, and it was then planned to develop an eventual full freeway; the initial construction being on an expressway basis with some private driveways and public road connections. Route studies culminated in a public meeting in Twain Harte in May 1960, where the results of the studies were presented to the residents of the area.

Route Adopted

After consideration of all information and viewpoints, the Highway Commission on July 20, 1960, adopted a route between Sonora and McCoy Saddle (near Pinecrest) that includes this first construction project.

The adopted route generally follows the present road, except for close-in bypasses of Twain Harte, Mi-Wuk Village, and Long Barn. The present state highway through these communities will be relinquished to Tuolumne County, but connections to the new freeway will be provided at each end of these bypasses, thus allowing quick and convenient access to the existing business and residential areas. The new highway will provide safe and convenient travel to the higher mountain areas, while leaving much of the present road to service the present and future recreational facilities. The planned ultimate development is a full freeway with interchanges at local roads and with frontage roads to serve local properties.

Notorious Grade Eliminated

The first project has eliminated the notorious Twain Harte Grade, between the small settlement of Mono Vista, about seven miles east of Sonora, and Hunts Camp, west of Twain Harte. This mile-long grade rises at a rate of 7 percent through a series of sharp curves that have been a major source of delay, frustration, incon-

The connection at Soulsbyville Road near Mono Vista. The new highway rises in the distance towards Hunts Camp, above the old road.

venience, and danger whenever there was an appreciable amount of traffic. It used to be common occurrence to have long queues of automobiles crawling uphill behind a truck, or moving slowly downhill in a single file when concentrations of homeward-bound people exceeded the capacity of the old road.

All this is a thing of the past, now that this section of new freeway has been completed. The new highway begins about one mile west of Mono Vista, passes by its southern edge, about 800 feet south of the former road, and then draws closer to the former road, running practically adjacent to it for the upper one mile, ending at Hunts at the top of the grade.

In the planning and design of this new road, the uppermost consideration of the engineers was the preservation of the unique character of the area, while keeping in mind the freeway standards that provide for the convenience and safety of the highway users. In this sensitive region, with its many homes set in natural surroundings, often in locations with pleasing views, the location and construction of a full freeway with control of access required careful consideration of many individual problems.

Scenic Surroundings Preserved

In the location and geometric design, a number of engineering techniques were utilized to minimize the disruption of the scenic surroundings. For example, an adjustment was made in the alignment which eliminated a high fill through the most highly developed portion of Mono Vista. The alignment was set along a ridge lying south of the built-up area, allowing the ascending grade to be placed where it would blend into the rolling mountain terrain.

To minimize the scarring of the hillside where heavy grading was necessary along the hillside above the present highway, the expedient of separate uphill and downhill roadways was used. The grade of the uphill roadbed was set as much as eight feet above the lower in order to fit the country more closely than would have been possible by use of a conventional four-lane section.

These initial four lanes are divided by a wide 46-foot median, except on the sidehill section where a 60-foot median is used. Two future interchanges have been designed into the roadway; one at Soulsbyville Road in Mono Vista, and one at the top of the grade near Hunts Camp. Here again, the design has been made to fit the terrain and to provide connections to present roads and future developments on either side of the freeway. Channelized grade connections have been constructed initially at these two places, but right of way has been acquired to accommodate the ultimate interchanges, as well as future frontage roads which can be constructed when conditions warrant them.

Weighing Facilities

An incidental problem involved the need to provide weighing facilities for westbound trucks near Mono Vista and an area for scaling platforms to

CALIFORNIA FEDERATION OF WOMEN'S CLUBS

December 10, 1963
Box 373
Twain Harte, California

Mr. John Meyer
District Engineer
Division of Highways, Dist. X
Stockton, California

Dear Mr. Meyer:

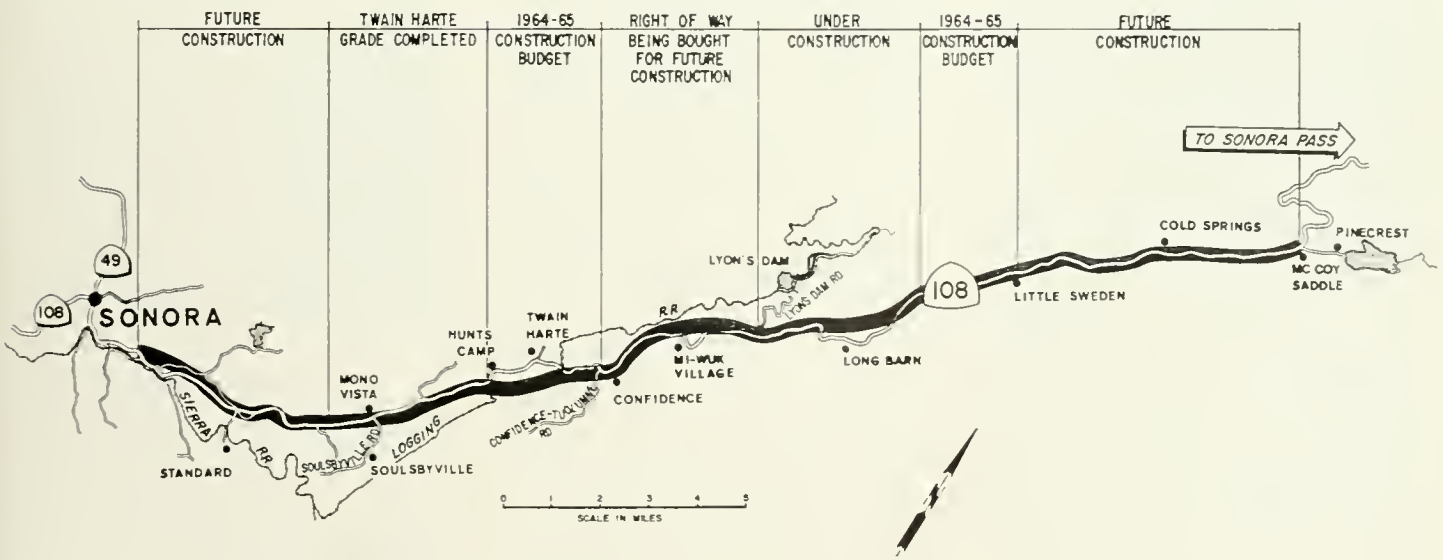
I am writing you to express my sincere pleasure in our newly completed highway, replacing the old Twain Harte Grade on Highway 108.

As you well know I took a deep interest in the planning and execution of that particular piece of highway and was at times volubly critical. So in fairness to you and your staff I wish to offer my congratulations on a beautiful job well done.

The safety angle alone makes it most acceptable, but it also opens up a very pleasant new panorama of our countryside.

Very truly yours,

(s) Mrs. Ruth C. Clarke
Member, Board of Directors
Twain Harte Women's Club



PROJECTS ON ROUTE 108

Looking west toward Soulsbyville Road from the first curve in the new grade. Note the roadways on different levels.

serve logging trucks bound for sawmills south and west of Mono Vista. These installations were placed between the freeway lanes and the exit ramp east of Soulsbyville Road, with access being from the left side of the ramp. It is expected that trucks can enter and leave the area conveniently and safely, with the least possible conflict with through traffic.

The design of the Twain Harte Grade project was started immediately after the adoption of the route, due to the urgent need of the improvement. Negotiations with Tuolumne County were carried on concurrently with design, and the freeway agreement was completed May 1, 1962. The plans were started by Carl M. Heynen, who died November 1960, and were completed by Robert F. Kraetsch, project design engineer.

Construction proceeded with no unusual problems after award of the contract in June 1962. There were practically no delays or inconvenience to traffic, as the construction was on entirely new alignment. The comparatively dry winter, previous to the storms in late January 1963, allowed the grading operations to be carried on at an unusually rapid rate, although the comparatively heavy spring rains caused some slowdowns. The project was opened to traffic October 21, 1963.

The construction was done under contract by O. K. Mittry & Sons, under the direction of F. M. Babcock, resident engineer.

A second project, between 2.4 miles west of Long Barn (Lyons Dam Road) and 1.7 miles east of Long Barn has been underway since July 1963. A continuation to 3.8 miles east of Long Barn (Little Sweden) is included in the 1964-65 fiscal year construction budget, and is expected to begin in the spring of 1964. Still another three-mile job, between Hunts and Confidence (Twain Harte Bypass), is to be started under the 1964-65 fiscal year program by doing the grading and by building an undercrossing and a railroad underpass. The paving will be done under a future program. Upon completion of this project, it is expected that traffic problems in the community of Twain Harte will be greatly reduced by the elimination of logging trucks and other through traffic, which will use the bypass.

Eventual Four Lanes

Between Hunts and Long Barn, it is planned to construct two of the eventual four lanes with initial grade connections to local roads and to certain portions of the present state highway that will become county roads.

Between Long Barn and Little Sweden, the improvement will generally consist of two new lanes on the southerly side of the present two-lane road, resulting in a four-lane facility. Here, as on the Twain Harte Grade, there will be about two miles where the new lanes will be below the present road, fitting the highway to the country by taking advantage of the sidehill terrain.

Along the portion from Long Barn easterly to Little Sweden, there has been a winter parking problem when people stop to play in the snow, and there have been times when only a single lane has been left for traffic. The addition of two lanes is expected to relieve this problem by providing a wider roadbed so that at least one lane can be kept clear in each direction.

Most Advanced Techniques

In the design for these projects, the most advanced engineering tools and techniques were used to provide for future conversion of the initial expressway to a full freeway by the construction of interchanges and frontage roads. The geometrics of the initial public road grade connections have been laid out and right of way is being acquired so that interchanges can eventually be constructed without disturbing local homes and businesses, while at the same time maintaining established patterns of local and through traffic.

As in the design of the Twain Harte Grade, one of the major concerns in the improvement of the highway has been to preserve and protect the essentially recreational characteristics of the area by setting the line and grade to minimize large cuts and fills, consistent with good standards.

It appears certain that these new highway projects will be a major factor in the development and general enhancement of all the communities and areas within its influence, while, at the same time, providing for the safety and convenience of local and long-distance traffic as only a freeway can.

L.A. DEPUTY CHIEF COUNSEL G. C. HADLEY RETIRES

George C. Hadley, Deputy Chief Counsel in charge of the Southern California Law Department and its San Diego branch office of the Division of Contracts and Rights of Way, retires on March 4, 1964, after completing a state legal career covering more than 30 years.

To succeed him, Chief Counsel H. S. Fenton appointed Reginald B. Pegram, who has been Hadley's chief assistant for the past 18 years.

GEORGE C. HADLEY

Hadley was born in New York but soon moved to California where he received his schooling in Whittier, Los Angeles, and San Francisco. He attended Stanford University and was graduated from Hastings College of Law in 1927.

He began his state legal career as a trial lawyer for the California Highway Commission in 1931, in San Francisco. From 1933 to 1936 he served as special attorney for Friend W. Richardson, Building and Loan Commissioner, to assist in the liquidation of defunct building and loan companies.

In 1936 he returned to the field of eminent domain law as trial lawyer for the Department of Public Works, again in the San Francisco office, but with increasingly frequent trips for trial work in the courts of Southern California. In 1945 he established the Los Angeles legal offices for the department and was placed in charge as its chief trial attorney. Under his guidance these offices have grown to a total staff of 34 attorneys in the Los Angeles office and its San Diego branch.

R. B. PEGRAM

During this long legal career he has prepared and tried over 300 cases; many of these have reached the appellate courts, and their decisions have to a great extent established our present eminent domain law.

As a specialist in eminent domain law, Hadley has lectured before appraisal and right-of-way professional organizations, and has written numerous articles which have been published in *The Appraisal Journal*, and in its manual on "Condemnation Appraisal Practice," published in 1961; he co-authored the "Digest of Cases on Eminent Domain," published by the Department of Public Works, for use by its attorneys and for distribution among the State's judiciary and public attorneys.

He is a member of the State Bar of California and has served for many years on its eminent domain committee; a member of the Los Angeles Bar Association serving on its eminent domain committee, as well as serving as one of its delegates to the State Bar conference for the past several years; and a member of the Los Angeles Lawyers Club.

His fraternal associations consist of Alpha Tau Omega (Stanford); member of American Masonic Lodge; Signet Chapter Royal Arch Masons; Los Angeles Commandery of Knights Templar; Al Malaikah Shrine Temple; and Elks Lodge No. 99, Los Angeles.

Hadley has accepted a partnership in a Los Angeles law firm, for which he will establish a real property and eminent domain trial section.

Hadley and his wife, Virginia, have one son, William.

Pegram, the new deputy chief counsel, is a graduate of Stanford University. He studied law there and at the University of Southern California.

From 1934 until he entered Navy service in World War II, Pegram worked for the land division of the Department of Water and Power, City of Los Angeles, first as a title officer and later as an attorney.

Most of his Navy duty was spent as a gunnery officer on destroyers in the North Atlantic.

He joined the Department of Public Works legal staff as a senior attorney in January 1946 and has been with the Los Angeles office ever since, being promoted to assistant chief in September 1963.

Pegram is a member of Chapter 1, American Right of Way Association, and is currently an adviser to its executive board. He and his wife Wanda live at 2016 North Vermont Avenue, Los Angeles. They have a son and two grandsons.

Agency Inaugurates Television Series

Leading off with Governor Edmund G. Brown's personal introduction, California's Highway Transportation Agency marked its entry into the field of regularly scheduled television on January 26th with a public information series produced by the agency. All phases of highway transportation are explored in this series, from the viewpoint of all the three departments – Public Works, Motor Vehicles, and Highway Patrol.

Initial air time is on KABC-TV Los Angeles, at 2.30 p.m. every Sunday through March – 10 weeks in all – with air time provided by the station in cooperation with the Farmers Insurance Group Safety Foundation. Governor Brown will introduce and close each show. Plans are now under discussion between Farmers and the agency to re-release the series elsewhere in the state, following its initial airing in the Los Angeles area.

Four of the programs, each 13 minutes, 40 seconds in length, were filmed in color for future reuse on TV or as information films used by the division's information departments. The balance of the series is being presented "live" with film and slide illustrations.

Filmed subjects are: "The Car Hunt," highlighting the highway communications network as it goes to work on a typical hit-and-run accident; "The Newcomer," illustrating the experiences of one of California's 2,000-daily new drivers in the process of getting a permit, licensing a vehicle, etc.; "Youth at the Wheel," on the facts and problems of teenage driving; and "Elbow Room," attacking the congestion problem and illustrating the freeway and expressway system as the State's answer to congestion.

The Klamath River Bridge at Orleons. This beautiful little suspensian bridge in the mountains of Northern California was the Division of Highways first prize winner.

PRIZE BRIDGES

By A. L. ELLIOTT, Bridge Engineer—Planning

ABOVE. The Georgiana Slough Bridge at Walnut Grove over an arm of the Sacramento River. This structure, designed and built by Sacramento County with the collaboration of the Division of Highways, won the first prize for movable bridges in the 1962 competition.

BELOW. The Howard Griffin Memorial Bridge across the Middle Fork of the Smith River northeast of Crescent City, which won an award in the 1962 contest.

CALIFORNIA CAPTURES FOUR MORE STEEL BRIDGE PRIZES

What is a good-looking bridge? And how do you design a good-looking bridge? These are pertinent and timely questions right now when more and more people are getting interested in the appearance of our highway structures.

In the face of this increased interest, California can again be proud of the record the Division of Highways made in 1963 in the national beautiful steel bridge contest sponsored by the American Institute of Steel Construction. A first prize and two awards of merit were received by the division's Bridge Department for bridges completed in 1962. A first prize was also received by Sacramento County for one of their designs in which the Division of Highways collaborated.

The first prize winner in the medium-span bridge class was the George C. Cole Memorial Bridge over the Eel River at Myers Flat. This green-painted, simple, three-span, all-welded structure found in the surrounding redwoods and the beautiful river a most attractive setting.

A similar attractive setting framed the Howard Griffin Memorial Bridge

over the rushing Middle Fork of the Smith River as it approaches Crescent City out of the Siskiyou Mountains in Northern California. The jury gave an award of merit to this two-span structure.

Combining the unique construction of curved steel girders with all-welded construction, the Elysian Viaduct in Los Angeles displays pleasing lines which captured another award of merit.

A simple, attractively designed swing bridge over Georgiana Slough as it nears the Sacramento River downstream from Sacramento at Walnut Grove, won for Sacramento County the first prize in the movable bridge division. The Division of Highways, after collaborating with the county in the design, felt pride in the finished result and submitted the bridge in behalf of the county.

This nationwide prize bridge competition has been held annually since 1928. Each year awards are given with first prizes in four categories and awards of merit as the jury feels are justified. The four categories are:

1. Long span bridges—one or more spans over 400 feet.
2. Medium span bridges — costing less than $500,000 and with no span longer than 400 feet.
3. Short span bridges—costing less than $500,000.
4. Movable span bridges.

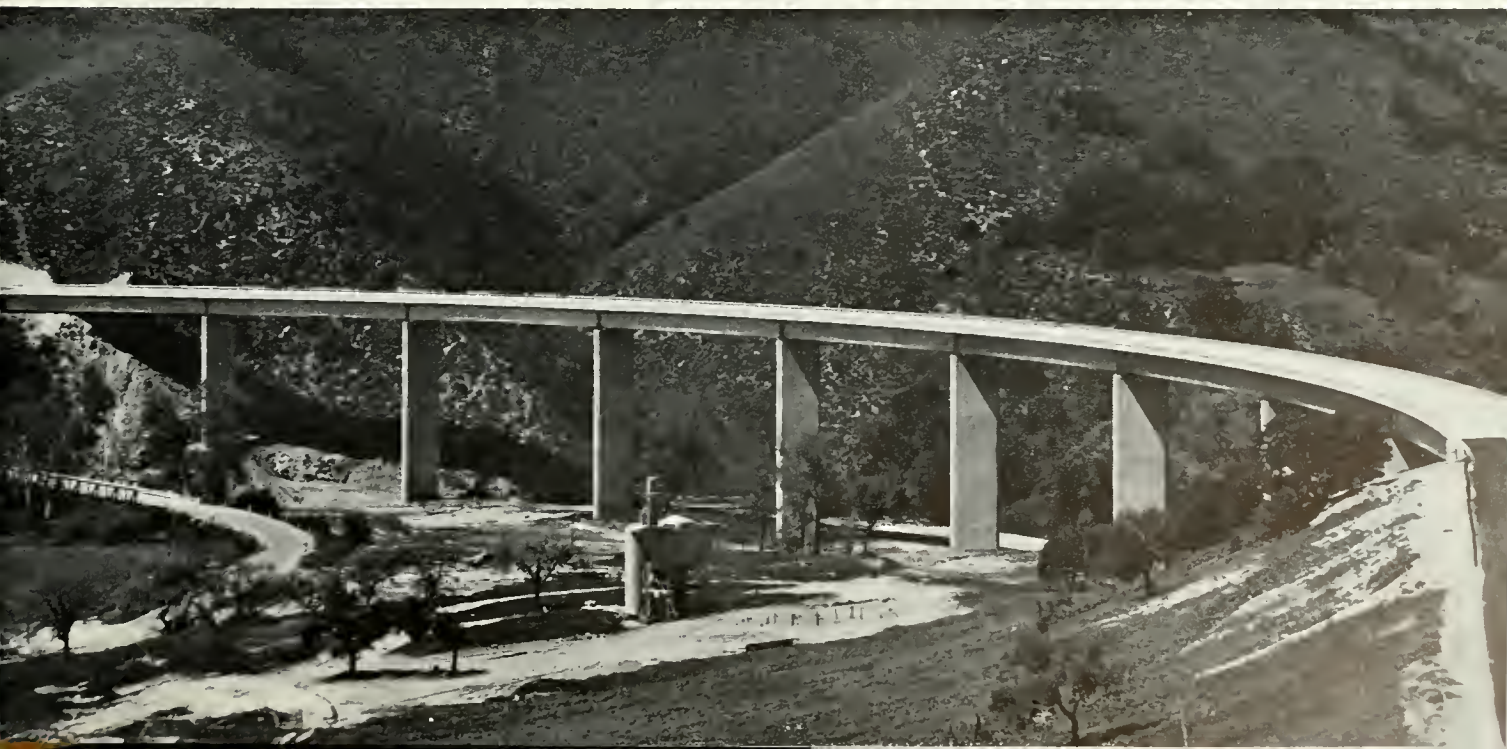
ABOVE. The George J. Cole Memorial Bridge across the Eel River at Myers Flat, a very attractive steel structure in the redwood country which received a first prize in 1962.

BELOW. The Ria Vista Bridge over the Sacramento River received a first prize in 1960 in the movable bridge classification.

Over the years, California bridges (state, county and, in 1937, the Golden Gate Bridge and Highway District), have won 7 first prizes and 17 awards of merit.

Although the AISC contest started in 1928, California did not appear in the win column until the 1935 award for the M Street or Capitol Avenue lift bridge over the Sacramento River

BELOW. Huasna River Bridge crossing an arm of a new reservoir near Santa Maria received a first prize in the 1959 AISC contest.



ABOVE. West Bay Crossing, San Francisco-Oakland Bay Bridge. An award winner in 1936 in the large structure class.

BELOW. The Elysian viaduct in Los Angeles using curved steel girders and all-welded construction, won an award in the 1962 contest. (See back cover, California Highways and Public Works, November-December 1963.)

at Sacramento. California next entered the limelight with a first prize awarded to the Golden Gate Bridge. This was not a state highway project, but this beautiful structure, in its unique setting, brought honor to all of California.

In the next year, 1936, the San Francisco–Oakland Bay Bridge won an award. Competition was keen among big structures that year and first prize went to the Triborough Bridge in New York City.

The Division of Highways gained its initial first prize in 1940 when the graceful suspension bridge across the Klamath River at Orleans took the top prize for the medium span bridges. This proved a great incentive and in subsequent years more entries were submitted. The effort paid off and in the years since 1940, numerous awards

and several first prizes have come our way.

The first prizes are notable. They include the 9th and 10th Streets Connection in San Francisco (1953). This was one of the first major welded structures. During the next six years California collected six more awards and then in 1959 again got the top billing with a first prize for the Huasna River Bridge near Santa Maria. This prizewinner was accompanied the same year by three other awards, making a sweep of four places for the year.

First Prize in 1960

In 1960, California again scored with a first prize for the Rio Vista vertical lift bridge. Along with it, a California county design also won an award. The following year brought only one award and then came the most recent success with two first prizes and two awards.

Coming at a time when the appearance of structures is of prime interest in many circles, this evidence of competitive excellence of the California designs is most gratifying.

ABOVE. The "M" Street or Capitol Avenue Tower Bridge over the Sacramento River at Sacramento. This structure was California's first recognition in the AISC contest and took an award in 1935.

BELOW. The Ninth and Tenth Street Connection Viaducts in San Francisco. These first all-welded major steel structures received a first prize in the 1953 contest.

Paint Analysis

Accurate and Faster Tests Done With New Instruments

By T. L. SHELLY, Associate Chemical Testing Engineer and
T. E. BURNS, Assistant Chemical Testing Engineer

Equipment

During the last 10 years a number of analytical instruments have become available to the Materials and Research Department laboratory which have greatly increased the efficiency in enforcing specifications. Since the majority of materials tested by the chemical unit of the department have specifications of the compositional type, it is imperative that methods and equipment be available to determine the composition of samples submitted as thoroughly, accurately, and quickly as possible. Among these new tools could be listed such instruments as the flame photometers; infrared, visible and ultraviolet spectrographs; gas chromatographs; and X-ray emission and diffraction spectrographs. These instruments have made it possible to do some types of analysis more rapidly than conventional chemical and in many instances made possible analyses which were previously virtually impossible.

The Materials and Research Department recently purchased a General Electric XRD-5 X-ray emission and diffraction spectrograph. This instrument will have many applications such as the identification of clay minerals, quantitative and qualitative analysis of metals, cements, and paint pigments. This discussion will be limited to the application of the X-ray diffraction equipment in the examination of a black and a white paint pigment.

A diagram of the apparatus used is shown in Figure 1. During the test the sample and the detector are rotated so that the X-ray strikes the sample at different angles. Certain angles give maximum reflection which depends upon the crystal structure of the material being analyzed. These angles of maximum reflection are detected and recorded graphically. As a scan of the sample is made over a range of several degrees, a curve such as shown on Chart I is obtained. The position of the peaks serves to identify the particular material but the height gives only an approximation of the amount of the material present.

Sample Preparation, Analysis

A completed paint pigment is generally a mixture of several raw materials most of which will exhibit a unique pattern in the X-ray diffraction spectrograph. In the completed paint pigment the pattern of each raw material will be evident. However, a peak of one raw material may overlap that of another.

All curves shown were obtained from paint pigments or raw materials. The paint pigments of completed paints were extracted by centrifuging to obtain the pigment for analysis. In routine control, however, a paper panel dipped in the finished paint and allowed to dry is satisfactory as a test specimen.

Charts I through IV show raw materials submitted by the manufacturer for the white paint. Chart V shows paint made in the laboratory using these raw materials. The major peaks used for analysis are identified on both raw materials and finished paints by number for easy comparison.

Chart VI shows a sample submitted by a manufacturer which agrees with Chart V except for minor variations in the height of the peaks.

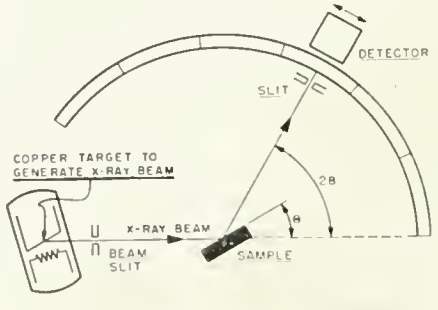


FIGURE 1. Schematic representation of X-ray diffraction equipment.

Chart VII and VIII show samples submitted by a manufacturer where the peak for calcium sulfate ($CaSO_4$) has a much lower intensity (Chart VII) or is entirely absent (Chart VIII). Subsequent chemical analysis confirmed this deficiency and the paints were rejected.

Chart II and Chart IX show the raw materials used in formulating the black paint. Chart X shows a paint made in this laboratory using these raw materials. Chart XI shows a factory sample giving a satisfactory curve. Chart XII shows a sample submitted which contains a pigment completely different than the one required by specifications. Talc (compare with Chart I) was used as a substitute in this instance.

Many thousands of gallons of these two paints were rejected as a result of the above analysis. In each case the deviation from the specification was confirmed by other methods of analysis before rejection.

It is anticipated that the use of X-ray diffraction together with X-ray emission will be of great value in many other types of analysis. A much more refined technique than that described in this article will often be necessary to obtain quantitative results accurate enough to determine specification compliance by X-ray analysis only.

Acknowledgments

This work was performed by the chemical unit, a part of the Technical Section under the direction of D. L. Spellman.

Appreciation is due to F. N. Hveem for his interest in promoting better laboratory control through instrumentation.

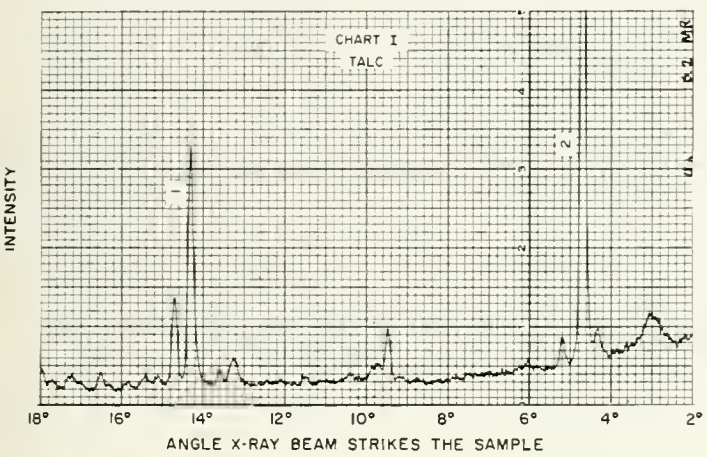


CHART I
TALC
INTENSITY
18° 16° 14° 12° 10° 8° 6° 4° 2°
ANGLE X-RAY BEAM STRIKES THE SAMPLE

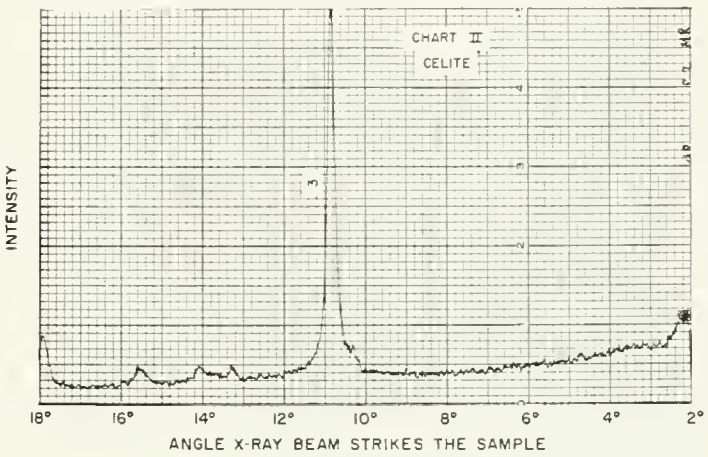


CHART II
CELITE
INTENSITY
18° 16° 14° 12° 10° 8° 6° 4° 2°
ANGLE X-RAY BEAM STRIKES THE SAMPLE

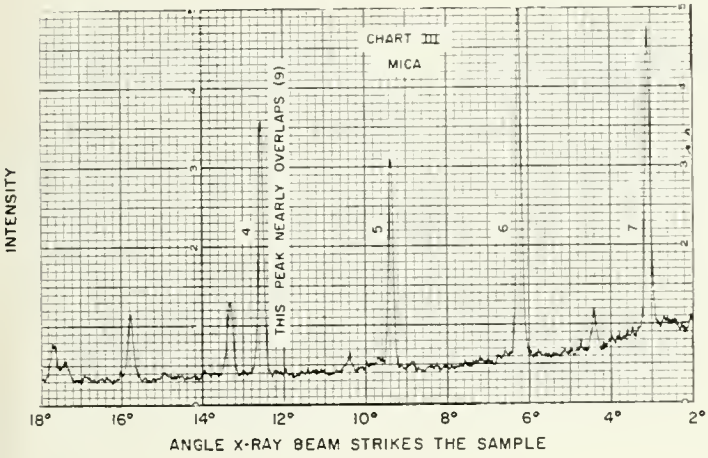


CHART III
MICA
THIS PEAK NEARLY OVERLAPS (9)
INTENSITY
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ANGLE X-RAY BEAM STRIKES THE SAMPLE

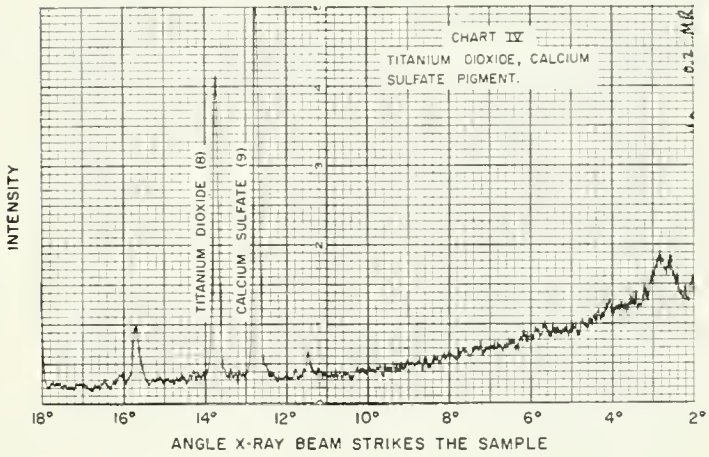
CHART IV
TITANIUM DIOXIDE, CALCIUM SULFATE PIGMENT.
TITANIUM DIOXIDE (8)
CALCIUM SULFATE (9)
INTENSITY
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ANGLE X-RAY BEAM STRIKES THE SAMPLE

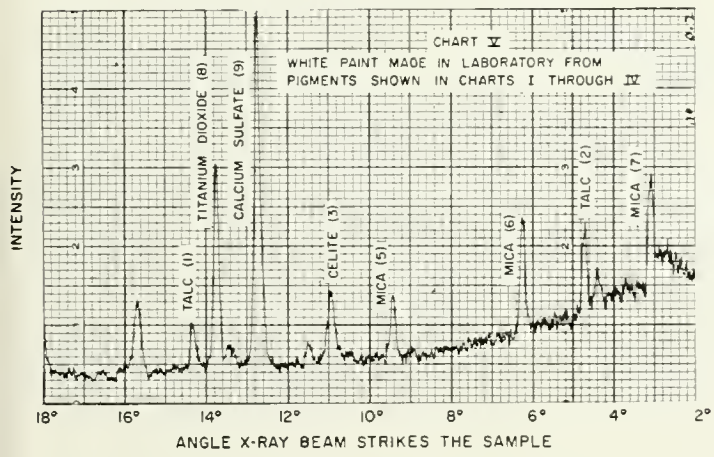
CHART V
WHITE PAINT MADE IN LABORATORY FROM PIGMENTS SHOWN IN CHARTS I THROUGH IV
TALC (1)
TITANIUM DIOXIDE (8)
CALCIUM SULFATE (9)
CELITE (3)
MICA (5)
MICA (6)
TALC (2)
MICA (7)
INTENSITY
18° 16° 14° 12° 10° 8° 6° 4° 2°
ANGLE X-RAY BEAM STRIKES THE SAMPLE

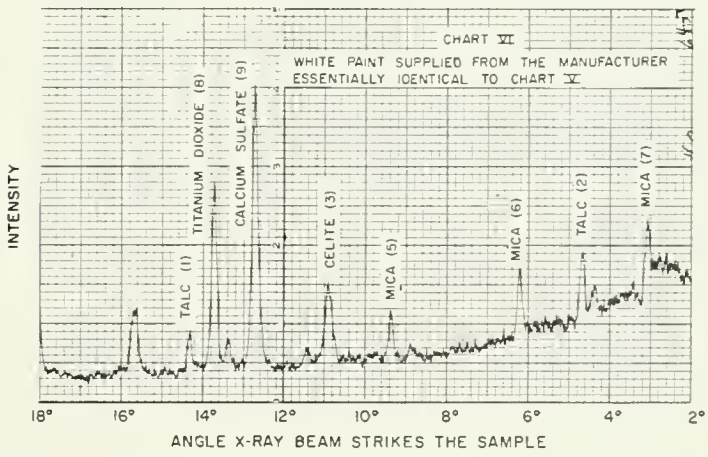
CHART VI
WHITE PAINT SUPPLIED FROM THE MANUFACTURER ESSENTIALLY IDENTICAL TO CHART V
TALC (1)
TITANIUM DIOXIDE (8)
CALCIUM SULFATE (9)
CELITE (3)
MICA (5)
MICA (6)
TALC (2)
MICA (7)
INTENSITY
18° 16° 14° 12° 10° 8° 6° 4° 2°
ANGLE X-RAY BEAM STRIKES THE SAMPLE

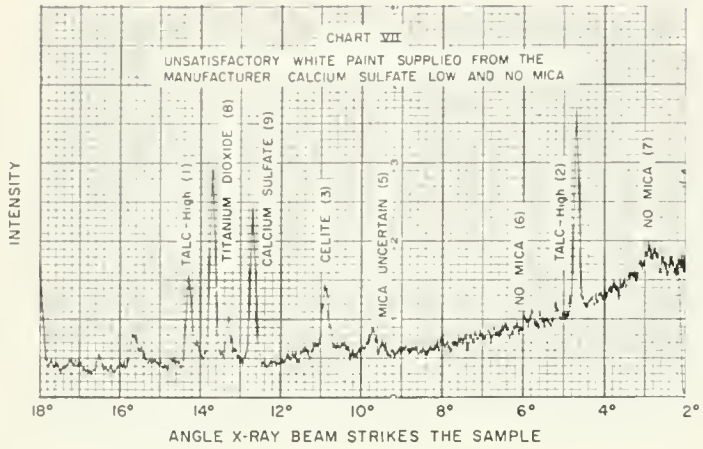
CHART VII
UNSATISFACTORY WHITE PAINT SUPPLIED FROM THE MANUFACTURER CALCIUM SULFATE LOW AND NO MICA
TALC - High (1)
TITANIUM DIOXIDE (8)
CALCIUM SULFATE (9)
CELITE (3)
MICA UNCERTAIN (5)
NO MICA (6)
TALC - High (2)
NO MICA (7)
INTENSITY
18° 16° 14° 12° 10° 8° 6° 4° 2°
ANGLE X-RAY BEAM STRIKES THE SAMPLE

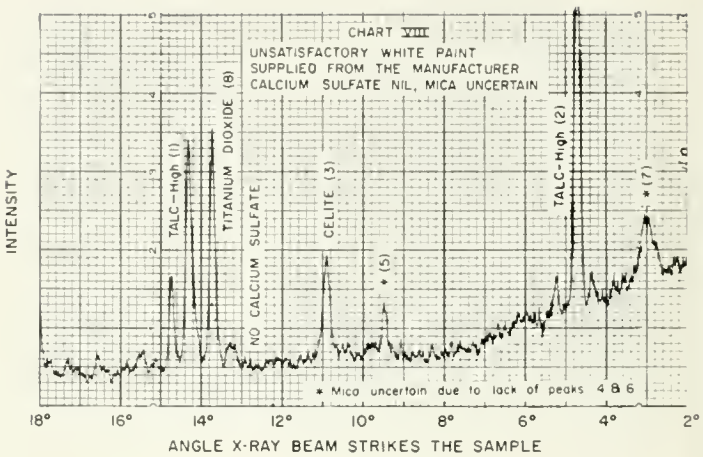
CHART VIII
UNSATISFACTORY WHITE PAINT SUPPLIED FROM THE MANUFACTURER CALCIUM SULFATE NIL, MICA UNCERTAIN
TALC - High (1)
TITANIUM DIOXIDE (8)
NO CALCIUM SULFATE
CELITE (3)
* (5)
TALC - High (2)
* (7)
* Mica uncertain due to lack of peaks 4 & 6
INTENSITY
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ANGLE X-RAY BEAM STRIKES THE SAMPLE

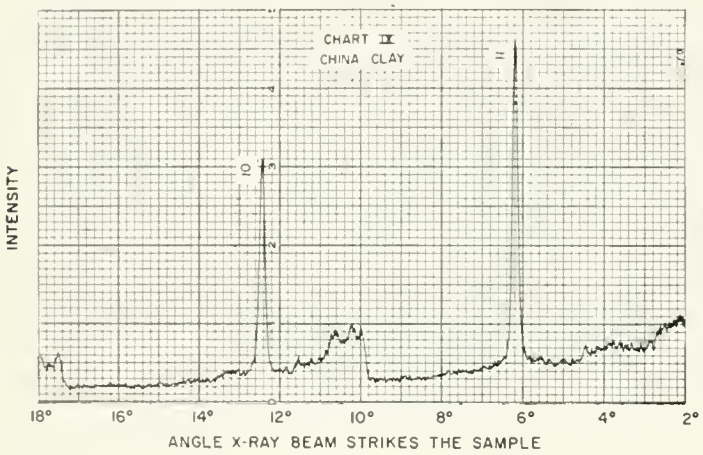
CHART IX
CHINA CLAY
10
11
INTENSITY
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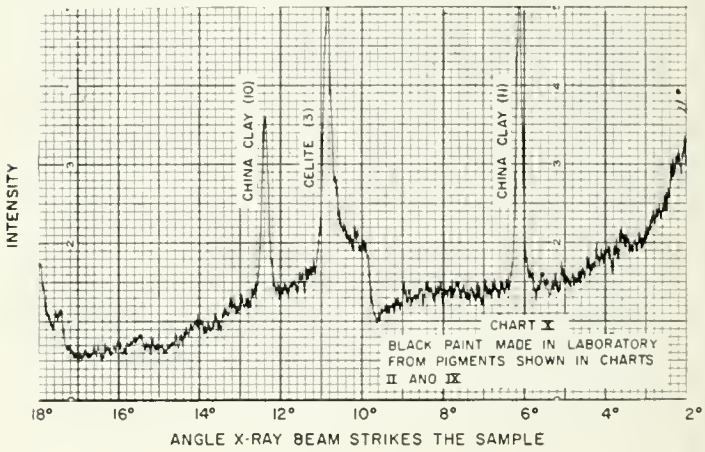
ANGLE X-RAY BEAM STRIKES THE SAMPLE


CHINA CLAY (10)
CELITE (3)
CHINA CLAY (11)
CHART X
BLACK PAINT MADE IN LABORATORY FROM PIGMENTS SHOWN IN CHARTS II AND IX
INTENSITY
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ANGLE X-RAY BEAM STRIKES THE SAMPLE

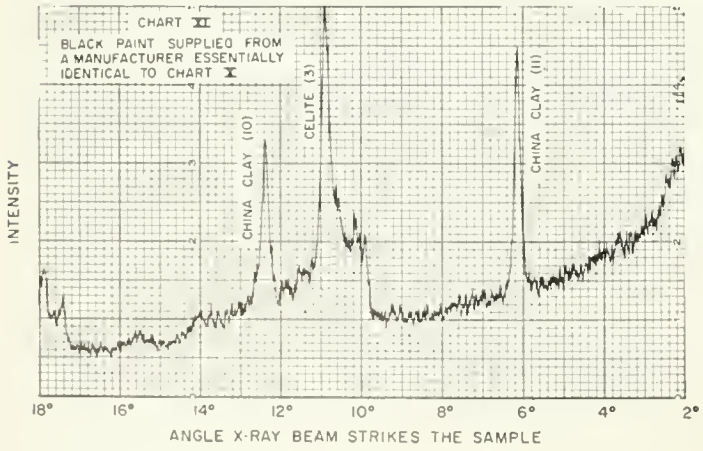
CHART XI
BLACK PAINT SUPPLIED FROM A MANUFACTURER ESSENTIALLY IDENTICAL TO CHART X
CHINA CLAY (10)
CELITE (3)
CHINA CLAY (11)
INTENSITY
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ANGLE X-RAY BEAM STRIKES THE SAMPLE

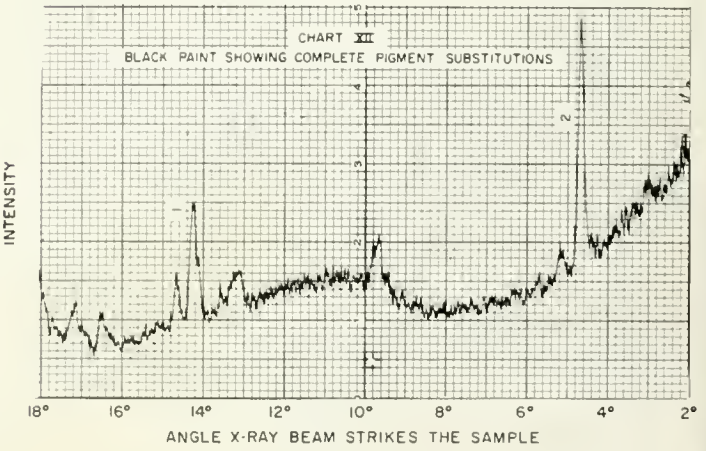
CHART XII
BLACK PAINT SHOWING COMPLETE PIGMENT SUBSTITUTIONS
INTENSITY
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ANGLE X-RAY BEAM STRIKES THE SAMPLE

Stanislaus County

Progress Report on Construction Projects

By HARTER R. BRUCH, Chief Civil Engineer, Stanislaus County

Two recently completed federal aid secondary projects on Stanislaus County roads have added five miles of road, constructed to F.A.S. standards, and have reduced the number of substandard bridges in the county by two. These improvements were made possible by the authorization, in 1956, of a $5 million bridge and highway improvement bond issue.

One of the projects, on Grayson Road, included 3.3 miles of road construction and the replacement of two bridges across the San Joaquin River. One of these bridges, the Grayson Bridge, west of Modesto, was the first major river bridge to be constructed in Stanislaus County, and was designed as a swing bridge to permit the passage of riverboats and barges. The original bridge was constructed in 1892. Both the replaced Grayson and the Laird Slough Bridges had been posted for a 12-ton load limit.

The old Grayson Road bridge across the San Joaquin River was constructed in 1892.

Carpenter Road

The second and most recent project was on Carpenter Road, along the west side of Modesto. The length of the project was 1.8 miles. This is the second F.A.S. project on Carpenter Road, the first being a new bridge across the Tuolumne River immediately to the south. A third proposed project, extending north, will com-

The new bridge across Laird Slough replaced an old structure posted for a 12-ton load limit.

The new bridge on Grayson Road across the San Joaquin River. See photo on the previous page.

plete Carpenter Road and provide a major north-south route along the western edge of the City of Modesto.

In six years, 1957 to 1962, $3 million of the total authorized $5 million bond issue have been combined with funds from other governmental agencies, to accomplish approximately $6 million worth of improvements to the bridges and highways in Stanislaus County. Other agencies which participated in these improvements under terms of cooperative agreements include the following:

Federal Government
- F.A.S. funds
- Flood damage funds

State Government
- State matching funds (F.A.S.)
- Flood damage funds
- State highway funds (cooperative funds)

County Governments
- San Joaquin County (cooperative bridge project)
- Merced County (cooperative bridge project)

City Governments
- Modesto (cooperative city-county highway projects)

14 Old Bridges Replaced

By the end of 1962, 14 antiquated bridges had been replaced, 7 bridges strengthened and 3 new major river crossing bridges constructed together with approach roads, to greatly improve the overall circulatory system. The total number of structures posted for load limits has been reduced from 38 to 13. In addition, a total of 13 miles of road have been constructed to federal aid secondary standards.

Chester H. Warlow

Chester H. Warlow of Fresno, former member and vice chairman of the California Highway Commission, died on December 10, 1963, after a long illness.

He was first appointed to the commission by then Governor and now Chief Justice Earl Warren in 1943. He served on the group until 1961.

A native of Illinois, Warlow came to Fresno with his parents in 1889, where he attended public schools. Later he studied at Kemper Military Academy in Boonville, Missouri, Stanford University and Harvard Law School.

He became a first lieutenant in the Army Air Corps during World War I.

Warlow began his bareer as an attorney and later became a banker and oilman.

In 1925 he helped organize the Sierra National Parks Highway Association. He was a leader in the program to get highways built into the Kings Canyon area, the Generals Highways linking Kings and Sequoia National Parks and the highway leading from Fresno to Yosemite National Park.

He helped form the San Joaquin Valley Statewide Water Committee in 1929 and was named chairman of the highway committee for the Valley Council of the State Chamber of Commerce.

His constant dedication to forwarding the highway program through his long career earned him the nickname of "Mister Highways."

Warlow has been lauded as a man who, during his time, unquestionably played a part greater than any other single individual to help the valley and the State generally solve its traffic problems through construction of more and better highways.

Warlow was a Past Grand Master of Masons in California and was an honorary 33d degree Mason.

He is survived by his wife, Marian.

New Routes

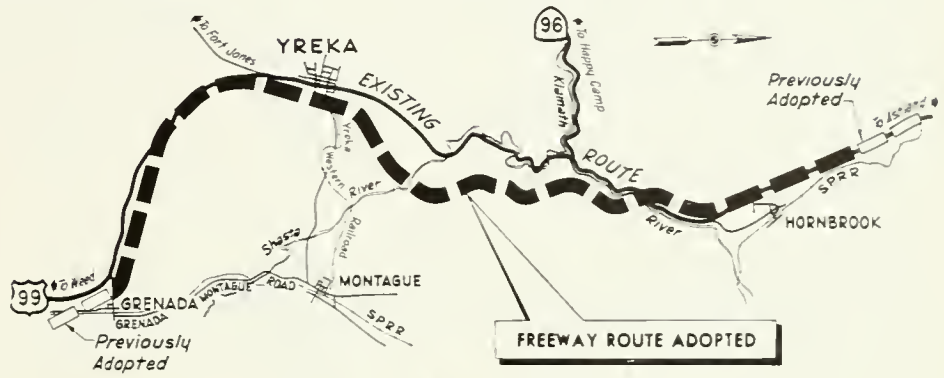
Location Completed for State's 800-mile Stretch of Interstate 5

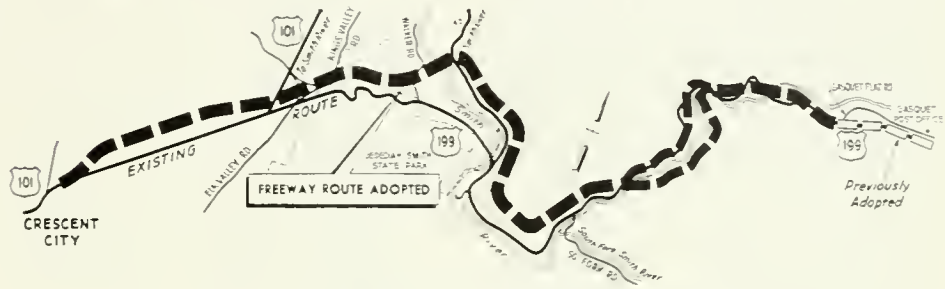
Freeway and other highway routings adopted by the California Highway Commission during the last part of 1963 were predominantly in the northern and central areas of the State, including one of the few interstate system sections which had not already been determined.

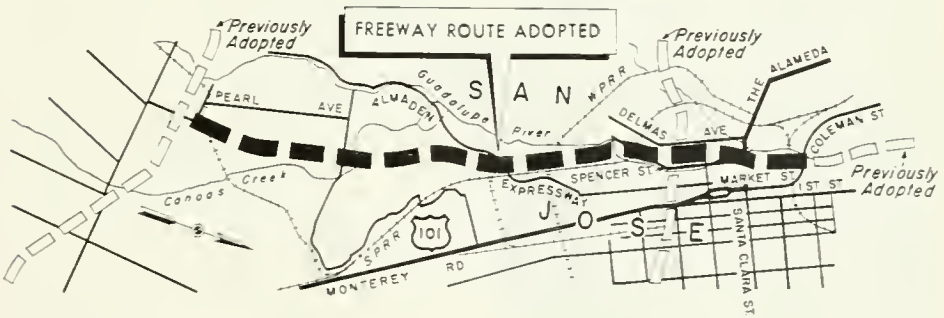
The interstate system routing adopted was a 26.5-mile section of Interstate 5 (old route U.S. 99) in the Yreka area of Siskiyou County. This action by the commission, at its November meeting, completes the route selection process for all of Interstate 5 in this State, covering 800 miles from the Mexican border south of San Diego to the Oregon line north of Yreka.

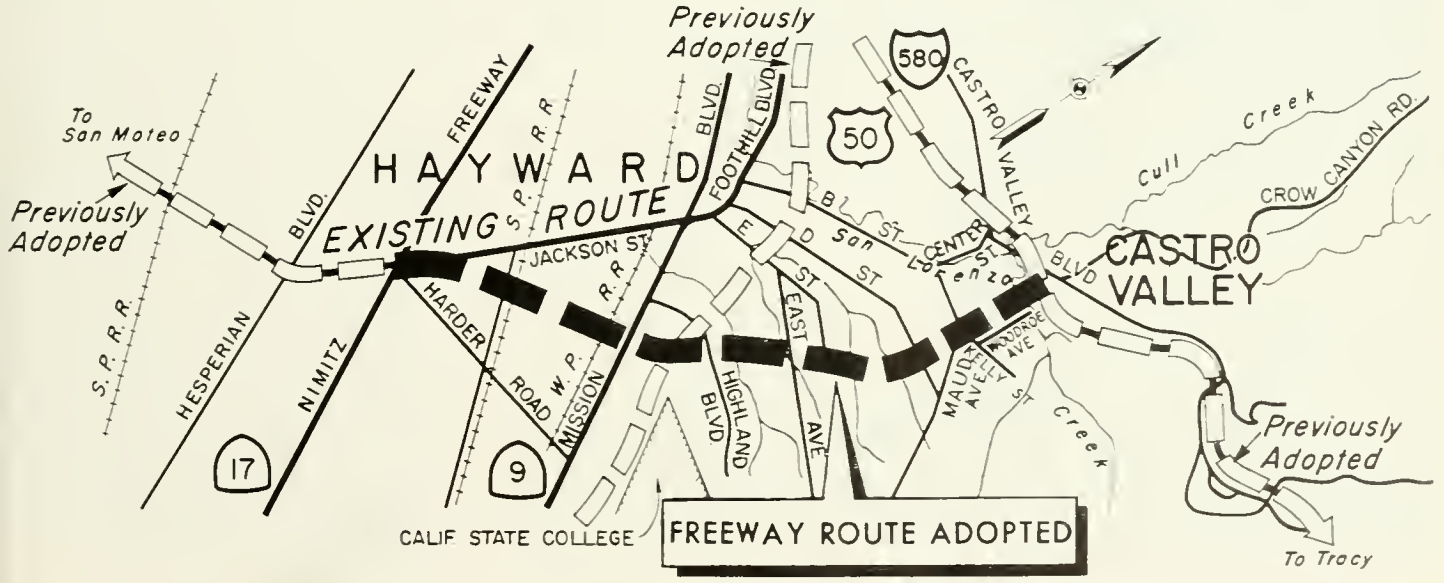
Other significant freeway routings adopted were in northern Del Norte County and in the urban areas of Hayward, San Jose and Fresno, as well as several in other sections of the State.

The Del Norte County routing involved 16.2 miles of U.S. 101 and U.S. 199 northeast of Crescent City. The routing runs to the north of the existing highway where it traverses a portion of Jedediah Smith State Park, and was endorsed by the State Division of









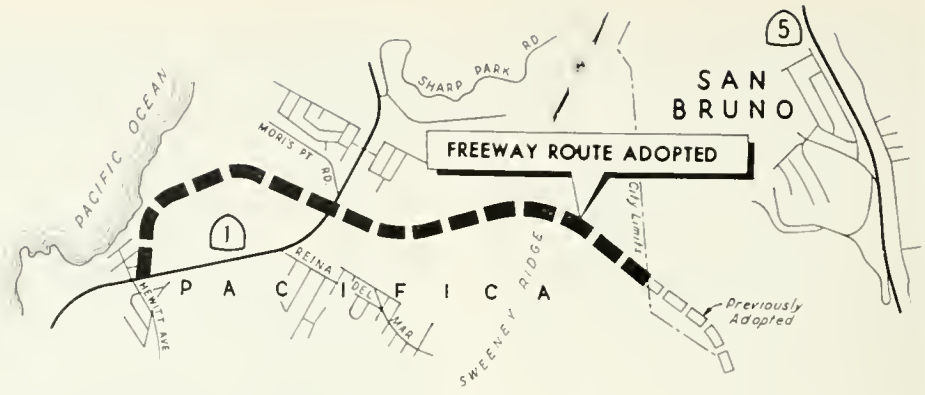
Beaches and Parks and by the U.S. Forest Service.

In the Hayward-Castro Valley area the commission adopted a routing for State Highway 92 (old Routes 105 and 259) between the Nimitz Freeway and Interstate 580, a distance of 4.6 miles, after a public hearing held in Hayward on October 10. The routing chosen is a combination of a route recommended by the State Highway Engineer for the westerly portion and a line favored by various local authorities and organizations which runs west of the proposed Don Castro Regional Park. A routing for 6.7 miles of State Highway Route 292 (new Route 87) was adopted in and south of San Jose. In the Fresno area, routings were adopted for Sign Routes 180 and 168. In both communities, as with the Hayward routing, the future freeways involved will provide metropolitan traffic service. Adoption of the routes at this time will facilitate local master planning.

Other new freeway routings included:

Humboldt County, two sections of U.S. 101—9.2 miles between Big Lagoon Bridge and slightly south of Orick, generally following or close to the existing highway; and four miles between south of Scotia and north of Rio Dell, running east of the existing highway in the latter community.

Fresno and Madera Counties—6.7 miles on Sign Route 145, between Whites Bridge Avenue near Kerman and just north of Avenue 5½; slightly east of and parallel to the existing highway.



San Mateo County—2.2 miles on State Highway Route 229 (new Route 186), between State Sign Route 1 in Pacifica and the Pacifica city limit at Sweeney Ridge; a new section of freeway, extending a routing previously adopted through San Bruno.

San Bernardino County—13.1 miles of Interstate 15 (U.S. 66-91-395) between just north of Devore and 1.4 miles north of Cajon Summit; cutting across a westerly loop around Blue Cut and providing for widely separated roadways between Cajon Junction and Cajon Summit.

Mono County—22 miles of U.S. 395 between a mile north of Casa Diablo and two miles south of Lee Vining; generally along the existing highway.

Stanislaus and Calaveras Counties—28 miles of Sign Route 4 between the San Joaquin County line east of Farmington and Sign Route 49 at Altaville; mostly along the existing highway.

San Joaquin and Calaveras Counties—14.7 miles of State Sign Route 8 (new Route 26) between the Calaveras River near Bellota and Sign Route 12 nea Valley Springs; generally following or north of the existing highway.

San Diego County—6.4 miles of State Highway Route 283 (new Route 103) between just south of U.S. 80 (Interstate 8) and U.S. 395; along existing Ward Road and Murphy Canyon Road.

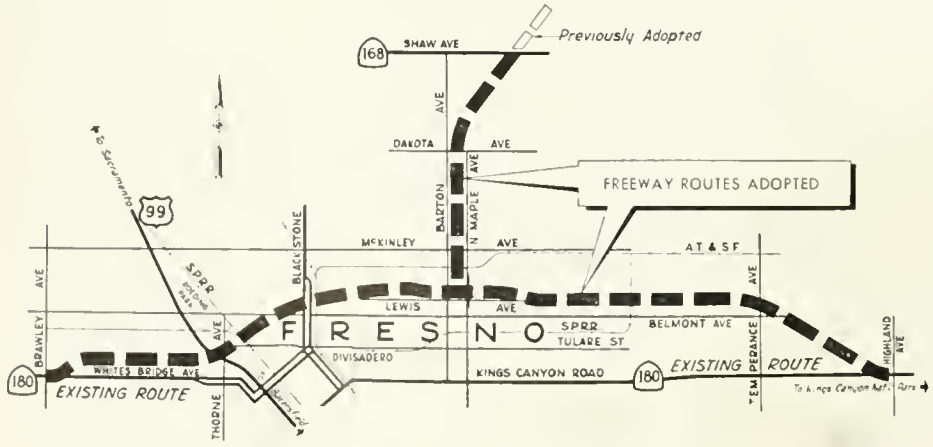
The commission also adopted several sections as conventional highways (nonfreeway) or as traversable routings.

One of these, in Chico, will move State Sign Route 32 from its present location in the vicinity of Chico State College to a new location to the south and west, using Eighth and Ninth Streets as a one-way couplet and then Walnut Street.

Another adopted routing extends a total of 10.8 miles between Georgetown and Sign Route 49 near Cool, in El Dorado County, omitting a 1.8-mile section which may be affected by a potential reservoir site.

Traversable highways were adopted in Butte County and Calaveras County, the former along Clark Road (Route 191) in and south of Paradise and the latter along Federal Aid Secondary Road 597 between Mokelumne Hill and West Point.

In the Los Angeles area, the commission adopted a routing for State Highway Route 163 (new Route 187) along Venice Boulevard between Lincoln and Sepulveda Boulevards, according to legislative description; and a 1.5-mile northerly extension of State Sign Route 27 in the Chatsworth area to connect with the adopted route for the Sign Route 18 Freeway.



Tijuana-Ensenada Highway

By EARL ROGERS, Associate Highway Engineer, District XI

U.S. Interstate Highway 5 begins at the international boundary near San Ysidro. It begins in a vast reservoir of humanity; of Mexican commuters and American tourists, of immigrants and vendors and uniformed border guards. Vehicles of every description, 54,000 on a summer Sunday, cross the border into Mexico and return—sports cars, rattletrap trucks, sleek limousines, big diesel semitrailers. Mingling with the autos are pedestrians, 24,000 of them, streaming into the sprawling city of Tijuana.

Interstate 5 has a common beginning with its counterpart in the Mexican State of Baja California. It is Mexico's Federal Highway 1 which may someday extend the length of the peninsula over 1,000 miles. At present it connects the border city of Tijuana with the deep-water port of Ensenada, 65 miles to the south.

Ensenada is, in a sense, the frontier of Baja California; for beyond is an immense wilderness of mountain and desert, of indescribably beautiful seacoast, of sparkling emerald bays, of missions whose crumbling walls are a haunting reminder of the Franciscans and the Jesuits before them.

Baja California is a sleeping giant. The stimulants needed to awaken it are water and highways. Water will come later, but the modernization of highways has already begun.

A two-lane paved road carries today's traffic south from Tijuana. It handles a growing volume of tourists traveling to the resorts and sport fishing facilities at Ensenada. It carries the adventure-smitten in their jeeps and campers bound for the surf fishing, the hunting, and the exploring of the remote regions of the Baja Peninsula. It carries increasing commercial traffic, for this is also farm country. Olives, wine, cotton, produce, and cattle must find their way to market.

It suffers from modern ailments; from too much traffic, substandard alignment, a high accident rate. It was built in 1935, improved in the intervening years, but a widened bridge or a straightened curve can no longer keep pace with the growing traffic volumes.

The new Tijuana-Ensenada Highway will skirt the west coastline of Baja California more closely than the old route, as shown in the above map.

Grading operations on the new highway showing windrowed base material on the southbound lane in the foreground. The northbound lane is in the background; the old highway is upper right.

A native stone gravity retaining wall along the old highway. New construction can be seen on the hillside, upper right.

The freeway concept is the only solution—controlled access, grade separations, a divided roadway. A 65-mile project is now under construction. When completed, it will provide uninterrupted traffic flow from the outskirts of Tijuana to Ensenada.

Design

A Mexico City firm, Ingineros y Arquetectos S.A., in addition to being the prime contractor, has also been responsible for designing the project. Centerline location and topographic mapping were done by field survey. Standards for horizontal and vertical alignment are based on a design speed of about 68 m.p.h. (110 k.p.h.).

A 24-foot median will separate the roadways with two 12-foot lanes for each direction of travel and 8-foot shoulders to the right of traffic. Separate grade lines for each roadbed will take advantage of the natural terrain, improve aesthetics, and help to economize on grading in sidehill locations. Grades will not exceed 6 percent. Fill slopes are about 1½:1. Cut slopes are steeper, ½:1 in most cases.

Four interchanges are planned; near Rosarito, El Descanso, La Misión, and Ensenada (see map). In addition to the interchanges, there will be seven major stream crossings requiring bridges. The longest structure (533 feet) crosses the tidal lagoon at La Misión. It will be a concrete box girder on reinforced concrete piling. Another major structure at El Morro has reinforced cylindical shells for the bent footings. Still another structure is founded on massive, unreinforced native stone bents and abutments.

Construction

All heavy grading is done by earthmoving equipment purchased from the San Diego area; tractors, scrapers, motor graders, carryalls, and shovels.

Trenching is done entirely by hand.

Arch culverts, pipe headwalls, and retaining walls are all unreinforced gravity structures made from native stone.

Reinforced concrete pipe is made near the jobsite.

If some of the construction techniques seem unmechanized, the reason is one of simple economics. Stone masons make about $3 per day. Heavy equipment operators make $6 per day with a bonus for dirt hauled. Form

A concrete pour on thin shell bent footings. The concrete is carried by wheel barrow to the timber cage, lifted by hoist and dumped into the chute.

Construction of thin shell bent footings at El Morro.

lumber is imported from the U.S.A. and considered expensive; thus masonry construction is used wherever possible.

Materials

Quality control is achieved by sampling and testing all materials. Bridge concrete is controlled by slump tests and compression tests on concrete cylinders.

Native stone used in retaining walls, drainage structures, and bridge bents is tested for deterioration by immersion in sodium sulfate solution. Axial compression and specific gravity tests are also made.

The roadway structural section consists of two layers of subbase 10 cm. each, a layer of base at 15 cm., and 6 cm. of asphalt concrete surfacing with a fog seal of RC 800. Atterberg limits and the California bearing ratio (CBR) are tests used to control the quality of base material.

The Proctor test measures relative compaction. Embankment requires 90 percent compaction to within 50 cm.

Grading on the new highway. The old highway is to the left. The pole line in the center will be moved outside of the right-of-way.

Workmen construct a native stone bridge pier.

of finished grade. Above 50 cm. the requirement is 95 percent.

Administration and Financing

Mexico has a system of federal, state and toll highways similar to the U.S.A. The federal highway system is administered, financed, and maintained under the direction of the secretary of transportation and communications. State highways are built by the states from general revenue funds. Toll highways and toll bridges come under the jurisdiction of Puentes y Caminos Descentralisados de México.

The existing Tijuana to Ensenada Highway is a part of the federal system. The new highway, when completed, will be turned over to Puentes y Caminos, etc. and become a toll road. The exact toll charge will not be set until construction is complete, but is expected to fall between $1 and $1.20.

Adolfo Briones Martínez is the engineer representing the secretary of communications and transportation.

Project cost is $16 million. Bridges account for $960,000 of that figure.

The contractor is working more than 700 men on two eight-hour shifts per day in an effort to complete this 65-mile project by September 1964.

The location of the new highway was deliberately chosen to afford a scenic view of the rugged, primitive coastline of Baja California. The motorist will see desolate stretches of sandy beach washed by white foam and clear water; rocky inlets lashed by incessant waves; and jagged cliffs rising vertically from the blue Pacific. He will roll across the tidal lagoon at La Misión where the seabirds rest on placid waters and he will climb high above the crashing surf along the cliffs swept by the sea breeze and the salt spray of angry winter storms. He will finally see the gentle sweeping curve of the Bay of Todo Santos with wispy marestails etched against the brilliant sky, and, like sentinels, the far-off mountain peaks of the Sierra Juárez.

Frank Balfour Leaves ARWA Secretary Post

Frank C. Balfour, National Executive Secretary for the American Right of Way Association and former chief right-of-way agent for the California Division of Highways, retired on February 1. Balfour who founded the association some 30 years ago, will continue to spend a great deal of his time working for the association as national coordinator.

He has been succeeded in the executive secretary's post by Robert R. Stone, who, until recently, was a supervising right-of-way agent with the division in Los Angeles.

Born in Pomona, Balfour graduated from the University of Santa Clara with a degree in electrical engineering in 1914.

He joined the Division of Highways in 1931 as an assistant right-of-way agent and was appointed chief right-of-way agent in 1943.

Under his direction, California's highway right-of-way organization came to be recognized as one of the outstanding of its kind in the country, a position which it has never relinquished.

Balfour was instrumental in the establishment of the Division of Highways policy which assures the payment of fair market value for property required for highway purposes.

Mountain Springs Grade

By DON W. GRAY, Resident Engineer

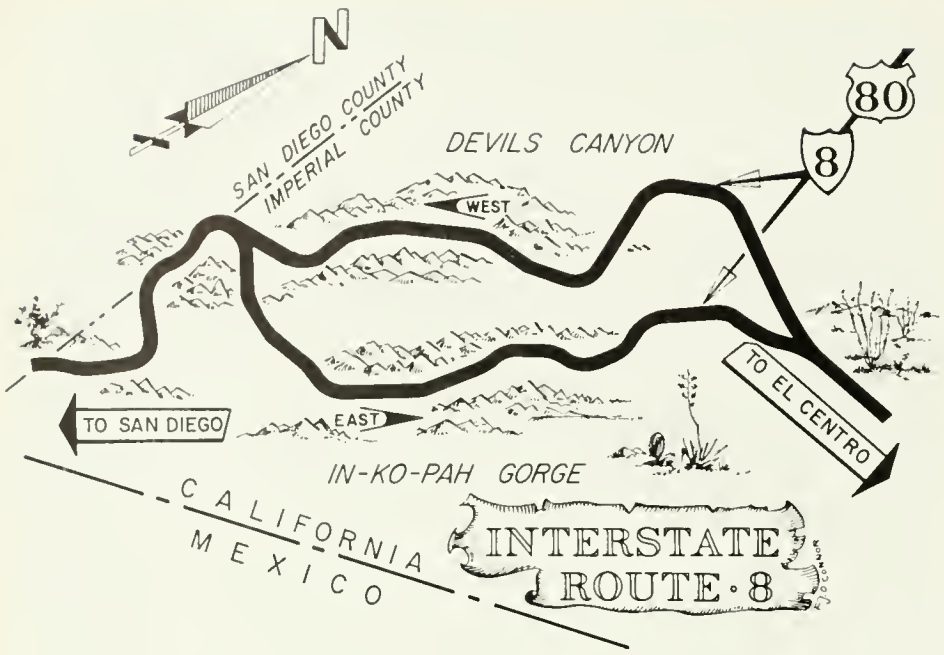
"Only the courageous or the desperate attempt to cross the mountains between San Diego and the Colorado River." These were words used to describe the hardships of travel through eastern San Diego County in the early California period prior to the Civil War. In addition to rugged mountains, an arid desert wasteland had to be faced in what is now the Imperial Valley, one of the largest agriculture-producing centers in the nation. Hostile Indians, politically inspired rivalry between the North and the South over the location of mail routes to the Pacific Coast, and the fact that large deposits of gold had first been discovered in Northern California, all tended to discourage development of little more than foot trails through the southern mountain ranges.

The mail route established by James C. Birch, which for a brief period of less than a year, in 1857, carried mail from San Antonio to San Diego by muleback was derisively referred to by northern partisans as the "jackass mail," or "the route from nowhere to nowhere." In 1863 two enterprising teamsters, Pete Larkins and Joe Stancliffe, built a small house at Mountain Springs, selling supplies and assisting the few hardy travelers up a 30-percent grade with teams of oxen. There is no indication that the road was heavily traveled.

Mineral Resources Discovered

By 1870 the discovery of valuable mineral resources in the Arizona Territory prompted the San Diego County Board of Supervisors to grant the San Diego and Fort Yuma Turnpike Company authority to establish a toll road in Mountain Springs Canyon. Although steep, narrow, and rocky, the road was successful. Typical charges

Devil's Canyon Bridge No. 2 under construction. The concrete forming can be seen protruding over the left side of the bridge.



were as follows: sheep and hogs, 1 cent each; horses and cattle, 5 cents each; horse and rider, 25 cents.

Additional pressure to establish a good road developed in the early 1900's when it was brought to the attention of San Diego civic leaders that $10 million worth of business from Imperial Valley and Arizona was being transacted with a northern neighbor. In the days before gas tax funds were available, the rather unusual method of a public subscription was used to raise $60,000 in order to construct a road suitable for automobile travel. In the words of a newspaper article of the day "The present road is of 22½-percent grade and includes 9 miles of sand. This will all be eliminated and made 11.3 miles long with 1 mile of 7-percent grade, 3 miles of 6-percent grade, 2 miles of 5-percent grade, and 5 miles of 4-percent grade with only 1 mile of hardly noticeable sand."

Construction began on November 2, 1912, under the guidance of Fred A. Rhodes, who was later to hold many responsible positions in San Diego City government. Mr. Rhodes recalled that there were numerous hardships. Good water was scarce. When a new well was dug, one of the mules was permitted to take a drink. If he reported for duty the next day, the water was satisfactory. If not, the well became the mule's final resting place. Arsenic is often encountered in the springs of these mountains.

Heavy Labor Turnover

It is not difficult to understand the reason for a heavy turnover in labor, since the 150-man crew lived in tent camps 50 miles from the nearest towns. Tents would be literally flattened under the 80-m.p.h. winds blowing down the canyon, leaving the men to seek shelter behind sand scoured rocks. A typical equipment spread of the day consisted of 40 mules, together with plows, wagons and stoneboats. All drilling was done with single jacks (one- to two-pound hammers) and hand-held drills. Black powder was the favorite explosive for blasting. The prime movers, the mules, were known for their sure-footedness on the narrow trails, as well as their ability to tell when lunch and quitting time came. They would stop pulling and bray. Apparently in the mule labor code, there was no such thing as overtime. In spite of dire predictions of failure, Mr. Rhodes not only completed the highway on schedule, but managed to conserve $13,000 of the original $60,000, which was returned to the subscribers.

The basic alignment of this highway was widened and paved with concrete in 1927. The last major realignment work in the area was completed in 1941 which served until late last year taking U.S. 80 traffic up the grade via Myer Creek Canyon.

Similar Problems

Muleskinners were replaced by catskinners on the recent contract which saw 10 miles of Interstate 8 completed at a cost of $5½ million. The probems faced were similar, however, the most important merely being able to get to the site of the work in the first place. The principal portion of the project follows Devil's Canyon, a mile and a half north of the present Highway 80. The alignment selected fell largely on steep boulder-strewn and faulted hillsides rising from the canyon floor at a 1:1 slope or greater. For the coming year the newly constructed 36-foot paved section will carry two-way traffic while work is proceeding on the realignment of existing Highway 80 in Myer Canyon. At the conclusion of this contract a four-lane divided highway with a mile and a half median (in places) will result. Myer Canyon will carry two lanes eastbound and Devil's Canyon will serve westbound traffic. The addition of extra lanes will expedite traffic through the area at the saving of boiling radiators and tempers when slow-moving vehicles would tie up long lines of motorists on the present route.

Isbell Construction Company, with main offices in Reno, Nevada, was the successful bidder on both contracts. The original critical path schedule prepared by Isbell showed a completion date six months in advance of the allotted contract time. Despite numerous setbacks, principally slides of already completed slopes, and adverse weather, the schedule was realized after time adjustments were granted for the additional work.

Project is Divided

Because of inaccessibility, the project was divided into three distinct areas, each separated by the two major steel girder bridges rising 140 feet

Looking south over the Mountain View—Devil's Canyon area. Bridge No. 2 is in the left foreground; Bridge No. 1 in right background. Community of Mountain Springs is visible in center background.

PHOTO ABOVE. Devil's Canyon Bridge No. 1 looking southeast. The old freight road can be seen in left middleground. PHOTO BELOW. A northeasterly view of a section of the new roadway showing cleanup operations in progress. The desert floor is visible in the distance.

Comparison of modern carbide insert drill bit (above) with two types from old projects.

A steel girder is moved into place on Devil's Canyon Bridge No. 2.

above the floor of Devil's Canyon and located in the geographical heart of the job. Pioneering and grading in each section had to be carried on independently of the adjacent sections, the only access being the remnant of a flood-washed early day freight road down Devil's Canyon and the roads blasted and dozed along the steep canyon sides by the contractor.

The preparation of the bridge sites and the erection of the girders accounted for a considerable portion of the total cost of the project. The girders, some of which measured 167 feet, are among the longest shop-fabricated on the West Coast. They were hauled to the near vicinity of the job by rail, transferred to trucks, and swung into place over the canyons by a 1,000-foot, 2-inch cable highline.

While the bridge crews were spanning the canyons, a double-shift grading operation was in progress moving 1,700,000 yards of rock to the fills. The two main production units were a 5- and a 6-cubic-yard electric shovel, each feeding a string of 20-yard rock trucks. These shovels work with deceptive quietness and efficiency. Loaded trucks rolling down steep grades under restraint of engine brakes and the day-and-night chatter of rock drills left no doubt that work was in progress.

Hydraulic Monitor

The fills were watered in ordered amounts by a modern adaptation of an early-day mining tool, the hydraulic monitor. The contractor purchased water in Jacumba Valley, 8 miles west of the project, and placed 17 miles of 16-inch and 4-inch waterline to supply water to the monitors and to conventional water trucks when the going became smooth enough to use them. State-furnished water load counters were installed on two trucks. These counters are designed to count each load of water and will operate only when the truck is completely filled and then emptied to within an inch of the tank bottom. An unexpected result occurred in that the counters showed more loads used than the driver reported. Traveling on rugged steep haul roads may have caused enough surge in a partially filled truck to trip the device and thus indicate an erroneous reading.

Drainage facilities consisted of corrugated metal pipe culverts. A structural plate pedestrian underpass at Mountain Springs has served at least one customer. A rare Borrego mountain sheep was observed trotting blithely through the installation. The same ram had been seen on other occasions acting as sidewalk superintendent overlooking drilling crews as they worked. Beside mountain sheep, snakes, and lizards, the culverts handled the heavy unseasonable autumn rains as designed.

Slopes are Flattened

The rocky appearance of the mountains proved deceptive in that 75 percent of the cut slopes had to be flattened or benched in order to achieve stability. The geological section of Materials and Research responded to many "mayday" calls to give recommendations on slope treatments. One report described an area as containing faulted, shattered, crushed, and pulverized zones with huge boulders and joint blocks 10 to 30 feet in diameter. The presence of those 30-foot boulders kept the contractor's explosives bill high. Three hundred fifty-six tons of ammonium nitrate fuel oil mixture and dynamite were used. Careful shooting was the rule, with an average of three-fourths pound of ammonium nitrate per yard required.

While the project might not qualify in record books as the "toughest" rock job, it will long be recalled by those who worked on it as the hottest (120° temperature in summer), the coldest (4° temperature in winter), windiest (80 mph winds still blow), rockiest, or sandiest piece of highway in memory. Scenic vistas with easy grades and slopes give little evidence now of the trials of early pioneers, or for that matter, of Isbell in constructing this modern highway.

The contractor was represented by project managers Larry Callahan, who handled the organizational phases of the work, Harry Varischetti, who served in the early production period, and Gus Jeppson, who completed the project for the Division of Highways. Eugene Calman served as district construction engineer, D. W. Gray as resident engineer, and R. Dean Brown, Bridge Department representative.

TWENTY-FIVE-YEAR LIST

The following employees received 25-year awards since the July-August issue of the magazine.

Headquarters Office

Arnold H. Carver
Robert B. Ely
Arthur H. Green

Headquarters Shop

Kenneth M. Runyon

Shop Nine

Herbert H. Junker

State-owned Toll Bridges

Cecil Wilkins Mills
Herman Tompach

Materials & Research

Margaret D. Lark

Bridge

Donald M. Daigle

District I

Darinka L. Gutsch
Edwin F. Parkhurst

District II

M. J. Elmslie
Hilmon Salinas
Lloyd M. Roth
James F. DeGusta

District III

Lucille Forrest (Palmer)
Harold Penrose
George H. Tanner
Herbert P. Trenery

District IV

Edward M. Hill
Erwin D. Houde
Lilia McAuliffe

District V

W. C. Henning

District VI

William H. Geier
Joseph H. Buckle
James E. Robinson

District VII

Betrice N. Waddington
Charley B. Lee
O. Paul Slagle
O. E. Bafford
A. C. Elofson
Bradford Shaffer, Jr.
Elizabeth Putman

District VIII

Ermal G. Boyd

District X

Harold L. Valverde
Maurice C. Riley
Leland N. Hack

Marsden Joins Staff Of Judicial Council

Warren P. Marsden, of Sacramento, an attorney for the State Department of Public Works for the past 14 years, has been appointed to the staff of the Judicial Council. Marsden will join the Administrative Office of the California Courts, the council's staff agency, which is located in San Francisco.

In announcing the appointment the Director of the Administrative Office, Mr. Ralph N. Kleps, said, "Warren Marsden's experience in both public and private law practice will be of great assistance to us. We are also counting on his extensive background in the field of legislation."

WARREN P. MARSDEN

Marsden practiced law in Seattle, Washington, and was on the staff of the Attorney General of the State of Washington prior to Navy service during World War II when he was communications officer on the staff of a destroyer squadron in the Central and Western Pacific areas. He practiced in San Francisco from 1945 to 1949 when he entered state service as a deputy legislative counsel. In addition to his regular assignments in the legal division of the Department of Public Works, he has assisted every Governor since 1949 in the review of legislation prior to gubernatorial action.

A native of Seattle, Washington, Marsden was educated in Seattle public schools and the University of Washington. He is a member of the California, Washington, and Sacramento County Bar Associations.

IN MEMORIAM

Headquarters Office

Sam Lunetta, senior reproduction machine operator; Norman B. Deuel, information officer I.

District I

Vernon Bickford, highway engineering technician I.

District III

Clyde F. Moeckly, highway foreman; Ronald B. Hammons, delineator; Patsy L. Bagwell, engineering aide I.

District IV

James Harden, Jr., groundsman; Betty Wong, delineator; Lee M. Scoggins, highway foreman.

District VI

Gladys McKay, intermediate account clerk.

District VII

Augustine Lopez, highway engineering technician I; Pearson S. Shinn, engineering student trainee "D"; Merlin S. Berg, highway engineering technician II; John S. Elliot, highway engineering technician I.

Shops

William Gosney, automobile mechanic; Mary McPhee, intermediate stenographer.

Bridge

Edward W. Hartman, engineering aid II.

State-owned Toll Bridges

Norman Chabot, toll collector; Albert Fawcett, toll bridge maintenance man II.

NEW HRB CHAIRMAN

Wilbur S. Smith, a highway engineering consultant of New Haven, Connecticut, has been elected 1964 chairman of the Highway Research Board.

Smith succeeds C. D. Curtiss, of Washington, D.C., an official of the American Road Builders Association and former U.S. Commissioner of Public Roads.

_ompoc Projects

Approach Highways to Missile Bases Improved

By J. M. STURGEON, District Construction Engineer

The California Division of Highways and the County of Santa Barbara have completed three, and are working on a fourth, of a series of relocation, reconstruction and ealignment projects on the highways erving the missile complexes in the icinity of Lompoc.

West of Lompoc, the Navy has eveloped its facility at Point Argulo as both an operational and reearch center.

North and west of Lompoc, the ir Force has its Vandenberg Base.

The development of these bases has resulted in heavy increases in traffic in the past several years. All this increase was dumped onto a road system designed to serve a relatively quiet farming and mining community.

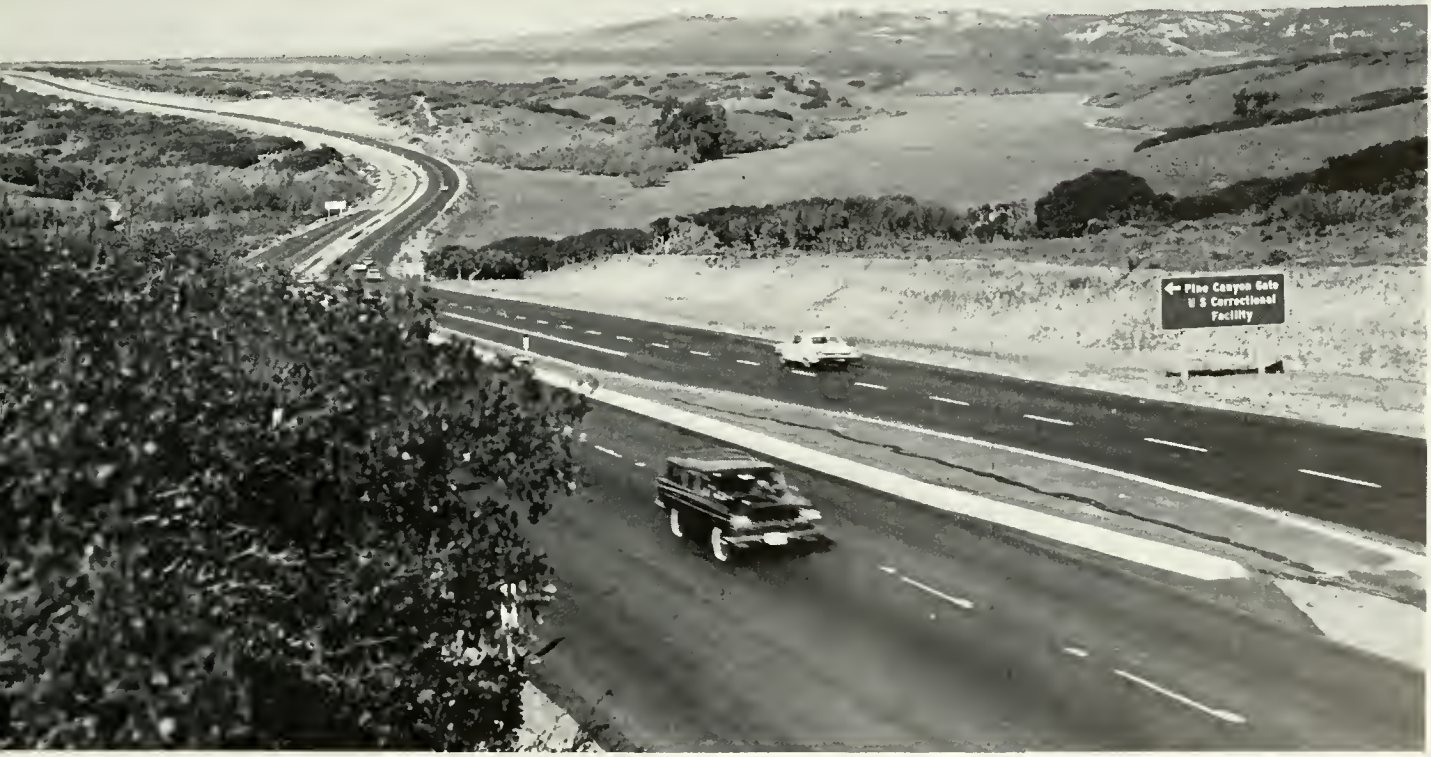
Highway 154, which serves Point Arguello, had a peak average daily traffic count of 1,523 vehicles in 1953 at the west city limit of Lompoc. By 1962 this had climbed to 6,200 vehicles. Traffic had increased more than 400 percent in nine years.

Traffic to Vandenberg

Vandenberg, served primarily by county roads, created an even greater surge in traffic demand.

In March of 1962, the Division of Highways received bids for reconstruction of about 2.6 miles of Highway 154 from the small railroad community of Surf on the coast back toward Lompoc. The low bid of $579,026.90 was submitted by E. C. Young of El Cajon.

Basically, this project involved reconstruction on new alignment of the existing narrow, twisting, structurally inadequate road to create a high-capacity two-lane highway around the perimeter of the Point Arguello facility, from the coast back to the main entrance. One bridge had to be constructed over San Miguelito Creek where it drained into the coastal



section of the new four-lane, divided expressway on Lompoc–Casmalia Road. The highway leads (left background) to the main gate of Vandenberg Air Force Base.

sloughs. Construction problems were the usual standard ones of wind, weather and soil variants. Of more concern was the necessity of dealing with the agencies involved in adjoining properties.

Near the middle of the project a "back door" feeder road to Vandenberg joined the new alignment, so the Air Force had an interest in the work. A Santa Barbara County coastal park also had to be served by this new facility. So the county had an eagle eye on and an interest in the work. Most concerned, of course, was the Navy, for whom this road will serve as a main access to its facility at Point Arguello.

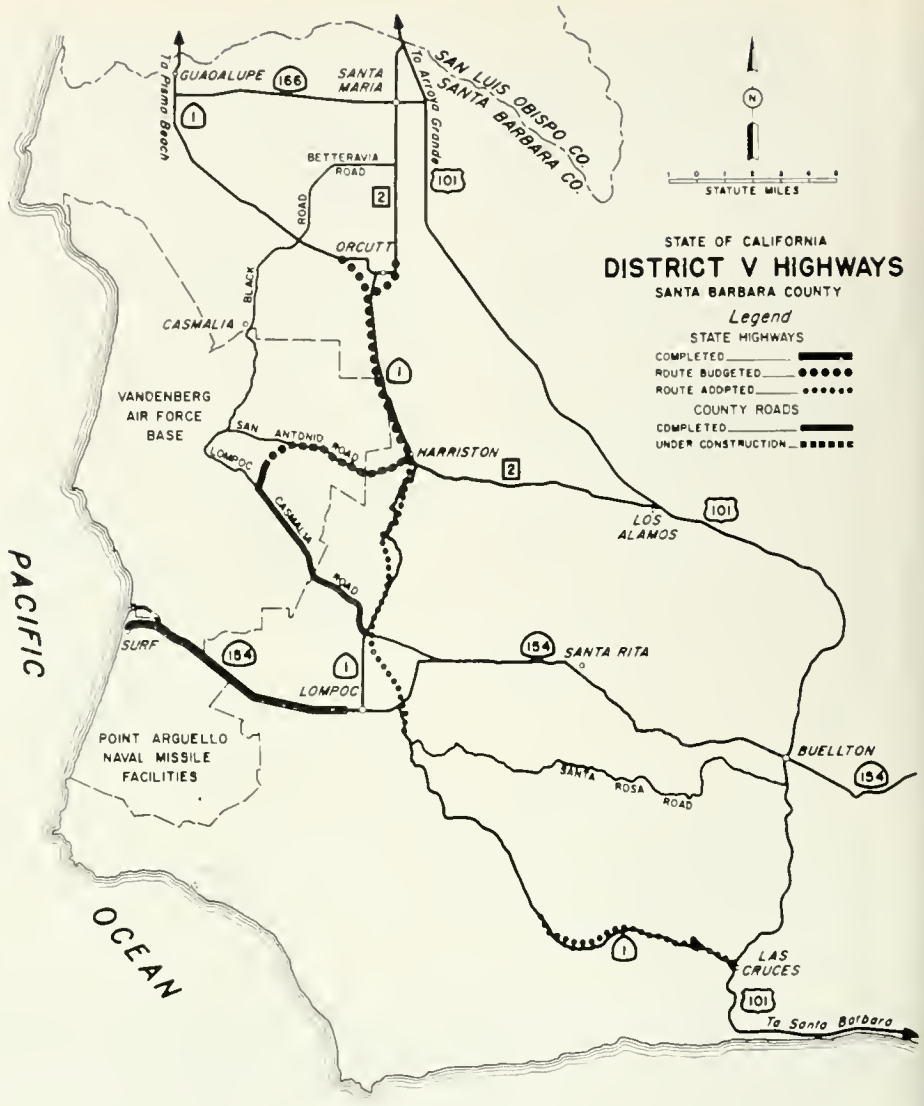
It is a compliment to the cooperative spirit of all parties concerned that there was no difficulty, argument or disagreement among or with any of the various organizations involved at any time during construction.

Missile Firings Cause Delays

Well—there was one *little* problem. Every time a missile was going to be launched from Point Arguello, a very determined-looking group of Marines arrived to escort everyone out of the area. This included contractor's forces, inspectors and the entire population of Surf. Arrangements had to be made, of course, to see that the contractor was granted a commensurate extension of contract time for each of these delays.

The project was originally scheduled for completion prior to April 25, 1963. Weather and rocket delays extended this, and the project was accepted on July 25, 1963.

In the meantime, on August 1, 1962, bids on a companion project from the end of this one on to the City of Lompoc, a distance of about 6.4 miles, were opened, and E. C. Young was again low bidder. This project was for $938,855. Work started on August 21, 1962, and continued for the next 11 months. While this contract also required reconstruction on new alignment, the new alignment topped, crossed, recrossed and paralleled the old so completely that traffic could not be carried on the old lanes while the new were built. Consequently, traffic had to be



A map showing the location of the various road improvements which serve the missile facilities in Santa Barbara County.

carried through construction at all times and in all phases.

In spite of the traffic and a high water table, the contractor finished the project on July 9, 1963.

The completion of these two jobs means that for the first time the Point Arguello Naval Facility has adequate access to and from the City of Lompoc and the surrounding areas.

County Completes Plans

While these access projects were being pushed ahead for the naval missile facility, the County of Santa Barbara completed plans and advertised for bids for reconstructing as a four-lane divided highway some 6.7 miles of the Lompoc–Casmalia Road, the main thoroughfare to Vandenberg AFB. Low bidder on this project was Coxco, JV, of Stanton. Work started on this $707,103.70 job on December 6, 1962. Though designed by the Santa Barbara County Road Commissioner's office, job engineering and inspection were carried out by Division of Highways personnel.

As construction proceeded, several minor changes in design were requested by the Air Force and were all incorporated into the work with little difficulty. As a result of excellent scheduling and coordinating by the contractor, the project was completed on August 19, 1963.

These three projects are only the start of the revised road net complex

Grading operations on the "Big Sand Cut" section of San Antonio Road east of Vandenberg Air Force Base.

The Lompoc–Casmalia Road at the main gate of Vandenberg Air Force Base.

Looking west along a new section of Sign Route 154 toward the seaside community of Surf. This highway also carries traffic to the Point Arguello naval missile facilities.

that has been planned by county and state forces to handle highway needs of these space age installations.

On April 17, 1963, bids were opened on another county road project. This one provided for construction, mostly on new alignment, of a feeder road between the Main Gate at Vandenberg and State Sign Route 1 at Harriston, south of Orcutt. Again, Coxco, JV, of Stanton was low bidder; this time at $1,146,635.50 for some 6.95 miles of road. The first three miles are to be a four-lane divided facility on completely new alignment. The last three miles follow existing San Antonio Road but "beef up" the structural section. Santa Barbara County is now working with the Air Force on plans for another project to carry the four-lane section on through to State Route 1 on new alignment.

Scheduling Is Important

Progress on this contract has been, again, characterized by skillful detailed planning and scheduling on the part of the contractor.

The major portion of the four-lane construction was completed and turned over to the county by December of 1963, beating the rainy season. By March 1964 the entire project will be complete and available to ease the load of commuter traffic on the existing road net.

To tie onto this project, the California Highway Commission has included in its 1964-65 fiscal year budget some $4,860,000 for a project to be advertised in the summer of 1964 for the construction of a four-lane freeway on Highway 1 from Harriston to Orcutt. This will result in the completion of state-county expressway-freeway facilities from Santa Maria and points north to Vandenberg, on to Lompoc, and from Lompoc to Point Arguello Naval Facility, a two-lane "freeway."

Not one of these projects in itself involved any departures from normal standard construction procedures (with the possible exception of having to stop work when missiles were launched).

Continuous Cooperation

Of outstanding interest, however, was the daily and continuous cooperation between many various interested agencies that was involved. State, county, Air Force, Navy, Bureau of Public Roads, city officials, railroad officials and private property owners all had to cross-consult, confer, discuss, be kept informed and most definitely cooperate for even the concept of these projects to be possible. The successful completion of these three projects and the pending completion of the fourth emphatically illustrates the doctrine that no one agency, no one individual, nor one organization can accomplish anything if the effects of the endeavor on others is ignored.

Resident engineer on the two Coxco, JV, contracts has been M. D. McAllister, Assistant Highway Engineer. The Surf to Main Gate at Point Arguello project was under Dyer C. Campbell, Associate Highway Engineer; and the project from Main Gate at Point Arguello to Lompoc was under B. D. Hensley, Assistant Highway Engineer. All the projects started and three completed under District Engineer E. R. Foley. The fourth was completed under R. J. Datel, now district engineer of District V.

Mountain Pass

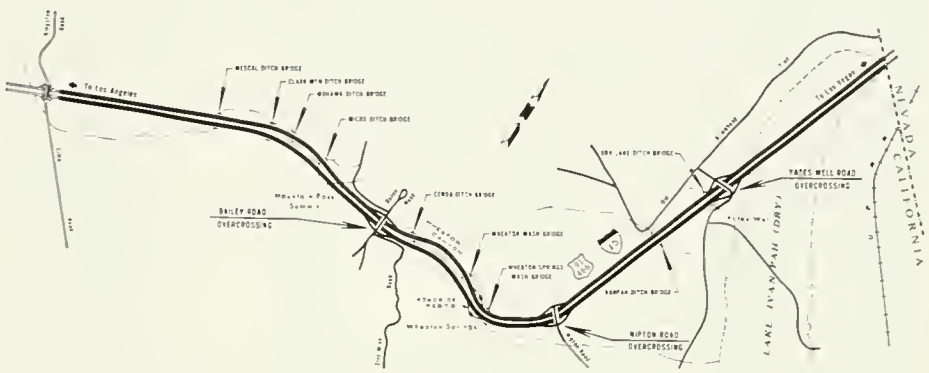
Another 23 Miles Completed On Interstate 15 in Desert

By CARL B. WOLFRAM, Resident Engineer

A high-standard freeway now traverses the Mescal and Clark Mountain ranges via Mountain Pass in the Mojave Desert and connects with the completed Nevada portion of Interstate 15 at the state border.

At a cost of over $6,000,000, the 23-mile improvement beginning 25 miles east of Baker will relieve the traffic congestions experienced in the past.

Regular cross-country traffic, combined with Los Angeles–Las Vegas trips, resulted in many a frustrated queue of cars moving up the curving grades, impatiently waiting for a chance to pass the slow trucks ahead. These sights are now scenes of the past.



The newly completed freeway closes the gap between previously constructed portions of Interstate 15 east of Cima Road and north of the state border.

Alignment Straightened

The new four-lane divided freeway follows a straight alignment up a steady incline for five miles, starting at the western end of the project to the vicinity of Clark Mountain Bridge. Here, the separated roadways gradually swing apart to form a wide median area providing room for a "dry" streambed.

With roadways converging again, the freeway approaches Mountain Pass Summit. Here, the motorist begins the 11-mile descent to the Ivanpah Dry Lake bed over 2,000 feet below the summit.

Scenic Values Preserved

Entering Wheaton Canyon, the roadways again sweep far apart, with Wheaton Wash (located on the bottom of the canyon) forming the median. This portion shows a good design solution for a divided freeway through confined, rugged terrain without destroying scenic values. A magnificent view awaits the motorist as he continues towards Nipton Road Overcrossing. The entire Ivanpah Valley extends below, with the New York Mountain Range forming the background.

The roadways again converge, separated by a 100-foot median, and continue for about 10 miles along a straight alignment toward the eastern end of the project.

Present Highway Widened

The existing highway was resurfaced and widened to form the new freeway at three locations. Furthermore, the new alignment crosses the old highway at several places. Construction, therefore, was scheduled in stages, requiring 12 temporary connections or detours, to facilitate the safe and orderly movement of existing traffic patterns.

Some existing service stations had to be removed to accommodate the wider highway. For the benefit of the traveling public during construction, 30 barrels filled with radiator water were placed at intervals along the entire project. During the hot summer months, these water points served as welcome oases for stranded motorists.

Safety Rest Areas

Presently, one tree-planted safety rest area for each roadway provides parking facilities and water for the traveler. The water is supplied from three spring sites at nearby Wheaton Springs and piped under gravity flow to drinking fountains at each of the roadside rest areas. Due to the extreme distance between interchanges and commercial facilities in this area, the roadside rests are used frequently.

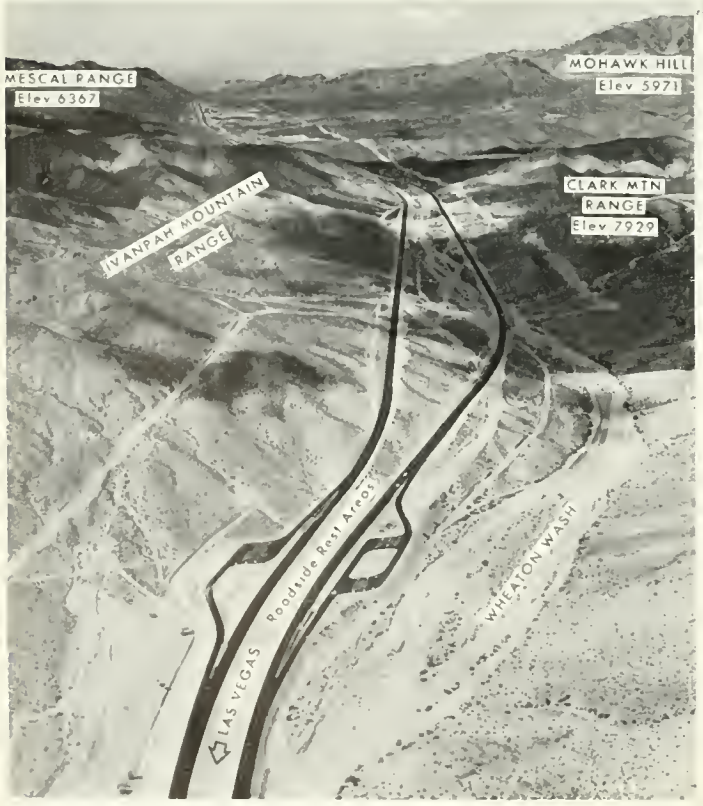
Two Structural Sections

Two structural sections were used for this project. The resurfacing section consisted of a minimum of 0.42-foot asphalt concrete over the existing highway. For the major portion of the freeway, the following structural section was constructed: 0.25-foot asphalt concrete on 0.5-foot cement-treated base and 0.33-foot aggregate base. In areas with low-quality basement material, aggregate subbase was placed in addition. Fifteen material sites throughout the project provided the required material for roadway embankments.

Extensive blasting was required to penetrate massive igneous and metamorphic rock formations in the Wheaton Canyon area. The contractor processed nearly 250,000 tons of aggregate for asphalt concrete from rock obtained from the roadway prisms.

Looking west from Bailey Road Overcrossing. The freeway traverses the mountain pass plateau.

The new freeway follows a straight alignment up a steady incline until the roadways gradually swing apart to form a wide median.



West of the Roadside Rest Areas, a portion of Wheaton Canyon with Wheaton Wash, a "dry" streambed, dictated the alignment of widely separated roadways.

Looking north from Nipton Road Overcrossing toward the Nevada state line, a distance of nine miles. The freeway follows the old highway (now new southbound roadway) with a maximum grade of 5.8 percent. Note old Arrowhead Trail of 1924.

Aggregate for base material was obtained and processed by screening operations at a site near the lower part of Wheaton Wash, where high quality alluvial sand and gravel deposits were found.

Self-propelled Machine

The contractor used a self-propelled, track-mounted machine to spread aggregate base and cement-treated base in a very efficient manner. The machine is equipped with strikeoff devices, so arranged as to spread windrowed material to a uniform depth and to the full width of two traffic lanes in one operation. A uniform rate of consolidation was obtained by means of oscillating rakers. Oscillating cutting screeds, set to uniformly strike off the material to the full width and to the predetermined thickness, accomplished the final shaping of the spread material.

Embankments across Ivanpah Dry Lake were covered with a six-inch blanket of rock to provide protection against the effect of wave action and possible erosion by saturation. An eight-inch layer of the same material was placed under the structural section to protect against saturation of the base by capillary action. Equalizer pipe culverts were installed at 1,000-foot intervals. These precautions are well founded. The danger of large quantities of runoff water filling the "dry" lake from either side always exists following high-intensity summer thunderstorms.

Water Supply Sufficient

Water, relatively plentiful through this portion of the Mojave Desert, was supplied by four wells near the west end of the project and was piped for 30 miles. Pumped to reservoirs at the Mountain Pass Summit, the water proceeded from there under gravity flow to a terminal reservoir at Yates Well Overcrossing.

Many existing timber bridges had to be removed. This was accomplished by collapsing the concrete deck and igniting the timber pile bents, which were extensively sprayed with oil. Smoldering all night, these burning structures must have been a sight of disbelief to the unsuspecting motorist. Nine new reinforced concrete slab

BEFORE. Snow surrounding Joshua trees at mountain pass summit, before construction.

AFTER. The same scene after construction showing Bailey Road Overcrossing as seen from west roadbed looking east.

Self-propelled track-mounted machine spreading aggregate base.

bridges span various "dry" streambeds located throughout the project. Three welded steel plate girder bridges are part of interchanges at Bailey Road, Nipton Road, and Yates Well Road.

As on other projects in the past, special care was taken to preserve native vegetation within the right-of-way. Any necessary disturbed areas, including material sites visible from the highway and roadway slopes, were seeded with native buckwheat at the end of construction activities.

Wide Variety of Weather

A wide variety of weather conditions was encountered during the construction period. Temperature variations of over 50° F. in a 24-hour period were recorded during almost any month of a year. Snow above 4,000 feet during the winter seasons did not interfere with construction operations as much as did low temperatures. Severe dust and sandstorms within the Ivanpah Dry Lake bed or high-velocity winds through the Mountain Pass area were a common occurrence. Localized thunderstorms of high intensity and of short duration caught many by surprise and caused moderate damage to not yet completed portions of the freeway. During the summer months of 1962, temperatures approaching 120° F. in the Dry Lake area created some uncomfortable working days for state and contractor's personnel alike. Generally, however, beautiful high desert weather conditions prevailed throughout the 20 months of construction activities.

Remains of long-abandoned mining camps are scattered throughout the area. Near Bailey Road Overcrossing, ruins and foundations of Nantan, a busy mining community in 1890, with weekly Wells Fargo stage coach service, are relics of a bygone era. Gold, silver, lead, and copper were successfully mined in the past. A copper smelter is still standing near the western end of the project. Today, only adobe ruins remain of old Ivanpah, a silver camp during the 1870's.

Rare Earth Deposits

The largest known rare earth deposits in the world exist near Mountain Pass Summit. Today, the Molybdenum Corporation of America is processing the highly concentrated rare earth ore, the only remaining productive mining activity in the area.

Prior to 1924, an unpaved road known as Arrowhead Trail, which was oil-treated shortly thereafter, generally followed meandering "dry" streambeds through Mountain Pass and Wheaton Canyon. Between 1933 and 1937, a greatly improved two-lane highway was constructed, which served as U.S. Highway 91 and 466 until 1963.

Construction on the new freeway was completed on October 25, 1963. J. B. MacDonald and Carl B. Wolfram were resident engineers for the State.

Retirement Claims 41 More Division Employees

The following employees have retired from the Division of Highways since the last list was published in September-October 1963 issue of *California Highways and Public Works.*

District I

Francis H. Rogers, senior highway foreman, 31 years.

District II

James M. Asher, maintenance man II, 35 years.

District III

Oscar E. Beach, highway superintendent, 37 years.

District IV

John E. Barrett, highway foreman, 42 years; Jack J. Bartlett, highway maintenance man III, 27 years; Anthony Correia, highway maintenance man II, 37 years; Esly J. Clogstone, highway maintenance man II, 27 years; Wetherby Boorman, highway field office assistant, 24 years; Lilia McAuliffe, senior clerk, 21 years.

District V

Paul W. Freeborn, highway maintenance man III, 26 years; Philip B. Stearns, senior highway engineer, 34 years; John A. Schorr, highway foreman, 29 years.

District VII

Myrtle F. Bachand, supervising clerk II, 32 years; Charles F. McCaffrey, associate right-of-way agent, 15 years; Marshall W. Burke, laborer, 30 years; Guy A. Lander, highway foreman, 31 years.

District VIII

Warren Ford, assistant highway engineer, 39 years; Ben R. Bond, highway superintendent, 39 years; Chester B. Jolley, highway foreman, 37 years; George Robinson, highway maintenance man II, 4 years; Troy L. Robertson, groundsman, 14 years; Joe F. Reith, laborer, 34 years; Frances Tyson, intermediate stenographer, 10 years.

District IX

James L. McCreary, highway foreman, 19 years.

District X

George A. Rhoan, highway maintenance man II, 35 years; Charles S. Diaz, highway maintenance man II, 36 years; James D. Forbes, senior delineator, 16 years.

District XI

John C. Krabill, highway maintenance man III, 30 years; Eugene C. Hatfield, highway maintenance man II, 19 years.

Headquarters

Dorris M. Robinson, intermediate typist-clerk, 7 years.

Bridge

Ivan Vinoff, assistant bridge engineer, 15 years.

Materials and Research

Francis N. Hveem, principal highway engineer, 45 years; Clifton C. Smith, janitor, 6 years; Margaret J. Fredericks, intermediate typist-clerk, 36 years.

State-owned Toll Bridges

Ivan P. Bunce, assistant highway engineer, 33 years.

Shops

Charlie H. Rosenbaun, highway maintenance man II (11), 33 years; Dan C. McRae, account technician III (2), 37 years; Leroy Shackleford, auto mechanic (6), 40 years; Charles W. Tracy, supervisor account clerk II (7), 31 years; Fred L. Greer, heavy equipment mechanic (2), 19 years; Alvin J. Koster, highway equipment supervisor I (1), 26 years.

Operation Carryall

Group Studies Possibility of Atomic Blast Excavation

A technical feasibility study recommending further evaluation of the practicability, safety and costs of conducting a series of nuclear explosions to open a two-mile railway and highway pass through the Bristol Mountains in California has been submitted to the U.S. Atomic Energy Commission, the State of California Division of Highways, and the Atchison, Topeka and Santa Fe Railway Company.

The report was prepared jointly by staff personnel of the railway, the highway group and the AEC's San Francisco operations office. The AEC's Lawrence Radiation Laboratory, at Livermore, provided technical assistance. The report recommends a more detailed study costing about $330,000 for engineering and public safety evaluation of a site in the Mojave Desert about 11 miles north of Amboy.

The joint group concluded that the application of nuclear explosives to blast such a cut through the Bristol Mountains for railway and highway use would be technically feasible. According to the report, it appears initially also that such a project could be conducted without endangering public health and safety. However, any decision on safety would be subject to much more detailed and exhaustive studies, such as studies of the seismologic, meteorologic, hydrologic, and geologic conditions of the area; and evaluation of predicted blast, shock and radiation effects.

A closeup of a section of the Project Carryall model showing the roadway excavation and the drainage crater (right foreground).

Plans for Retirement

The study resulted from plans of the Santa Fe to realign its route between Goffs and Ash Hill to eliminate 15 miles of trackage and reduce grade and curve problems to speed up transcontinental service. Preliminary investigations by the railroad indicated a line through the Bristol Mountains, but such a route would have required a tunnel through a large mountain or a detour to the south, both of which would have been uneconomic. In seeking a less expensive solution, the Santa Fe expressed interest to the AEC in the possibility of using nuclear explosives to make the cut.

The California State Division of Highways in turn was contacted as to the possibility of relocating the future alignment of Interstate Highway 40 (U.S. Highway 66). The Santa Fe's proposed line runs about one mile south of the future highway location

recently adopted by the California Highway Commission.

As visualized in the preliminary review, about 68 million cubic yards of earth would be removed, creating a cut about two miles long and ranging in depth from 100 to more than 350 feet, and having an average bottom width of 325 feet. Such a cut would permit construction at the bottom of a double-track railway and a four-lane divided highway capable of being expanded later to eight lanes.

22 Nuclear Blasts

About 22 nuclear detonations, totaling 1,730 kilotons, would be detonated in series, half of them at a time, to accomplish the removal of earth and rocks from the cut. An additional 100-kiloton explosion would be considered to excavate a sump to provide drainage for the area.

The study has been designated "Carryall" and is one of several feasibility studies being considered by the Atomic Energy Commission under its Plowshare Program for developing the peaceful uses of nuclear explosives. No excavation projects have been authorized under this program, although a 100-kiloton cratering experiment, Sedan, was conducted in 1962 at the Nevada Test Site, and a scientific experiment, Gnome, involving underground detonation of a nuclear explosive of about 3 kilotons, was conducted near Carlsbad, New Mexico, in 1961 as part of the Plowshare Program.

Nuclear weapons effects cratering experiments also have been conducted at the AEC's Nevada Test Site, and have contributed valuable data to the Plowshare excavation program. In addition, experimental cratering work has been carried out in recent years with conventional explosives to obtain data required in nuclear projects.

Civilian Uses Promoted

The development of nuclear devices especially designed for civilian uses continues at the Lawrence Radiation Laboratory, which is operated for the AEC by the University of California. The principal objective of this development work is cheaper devices producing a minimum of radioactivity.

The report estimates that cost of the sections of railroad and highway realignments affected by the nuclear excavation would be $21,722,000 by conventional methods; $14,552,000 for the railroad and $7,170,000 for the highway. (The railroad found the cost of rerouting by conventional methods was prohibitive.) The portion of the railroad realignment covered by the study is about 4½ miles and for the highway about 18 miles. Excluding charges for the nuclear devices the cost for achieving a joint realignment using nuclear explosives would be $13,765,000. The charges for the required nuclear devices are not estimated in the report because of uncertainties as to how much the charges may be reduced by development work.

The study will be reviewed carefully within the AEC.

Wyatt C. Winkler

Wyatt C. Winkler, associate highway engineer, died in Sacramento December 26 following a lingering illness.

Winkler, who has been with the division since 1935, was born in Blackwell, Oklahoma, March 10, 1906. He attended Oklahoma A. & M. and also the University of California, Los Angeles, before his employment as a junior engineering field aid in the District VIII office in San Bernardino. He alternately served this office and the District VII office in Los Angeles in varying engineering capacities until 1942, when he resigned to accept a position with the U.S. Engineers for construction of the Pan-American Highway.

He rejoined the division in 1943 as assistant highway engineer in District VII, and in 1950 was promoted to associate highway engineer. In 1953 he transferred to Headquarters, specifications section, where he served until the time of his retirement, December 14.

Winkler is survived by his wife, Georgia, who lives at 4489 25th Avenue in Sacramento, and three daughters. Survivors also include two brothers, two sisters, all of Southern California; and six grandchildren.

Ralph A. Tudor

Ralph A. Tudor, who served the Division of Highways and the Division of Bay Toll Crossings in many responsible capacities from 1929 until he joined the Eisenhower cabinet in 1953, died November 15, 1963, in his Atherton home at age 61. He was founder and vice president of Tudor Engineering Company of San Francisco, currently involved in designing and planning the Bay area rapid transit system.

Tudor joined the Division of Highways as a bridge engineer in 1929, and participated in the investigations, designs and construction of the San Francisco–Oakland Bay Bridge. In 1937 he was in charge of operation and maintenance.

In 1938 he was assistant administrative officer of the California Commission for the Golden Gate International Exposition on Treasure Island. As principal bridge engineer during 1939-40, he had charge of operation and maintenance of state-owned toll bridges, and assisted in the economic studies which led to the purchase by the State of Carquinez and Antioch Bridges and the refinancing of the San Francisco–Oakland Bay Bridge.

In 1941, Tudor—a West Point graduate—entered military duty, serving in Intelligence and also with the U.S. Army Engineers.

After the war he joined Morrison Knudsen International Company, and conducted a rail, highway, water and transportation survey in China.

When the Division of San Francisco Bay Toll Crossings was formed in 1948, Tudor was named chief engineer. In 1949 he was selected to organize a brigade of engineers for the U.S. Army Engineer Reserve, which was sponsored by the State Department of Public Works.

Appointed to President Eisenhower's cabinet in 1953, he spent 18 months as Undersecretary of the Interior, after which he returned to his own engineering firm, where he remained active until his death.

Tudor is survived by his wife and one daughter.

'Tempus Fugit' Corner

The following items appeared 25 ears ago in *California Highways and ublic Works:*

January 1939 — "Bay Bridge Terminal Officially Opened"

"As this issue of the magazine goes press, Governor Culbert L. Olson scheduled to officially dedicate the an Francisco-Oakland Bay Bridge rminal, initiating train operations on ie monumental structure spanning an Francisco Bay.

"One of the most imposing buildgs in San Francisco, the Bridge ailway terminal is on Mission Street etween First and Fremont. . . . Approximately 60,000 persons, it is conrvatively estimated, will pass through ie terminal daily. Due to the conenience of the terminal location, 50 ercent of these will be within walkg distance of their destinations. This comparable to 25 percent now ithin walking distance from the erry Building terminus. . . ."

February 1939 — "Bay Bridge Terminal Dedicated"

With a few formal words uttered the dedication ceremonies held in an Francisco January 14, Director of ublic Works Frank W. Clark turned er to Lieutenant Governor Ellis E. itterson, representing Governor Olon, the state-owned Bay Bridge and ate-built Bay Bridge terminal buildg and electric railway, the first railay ever to operate directly between acramento, Alameda County and San rancisco. . . .

"In completion of the formal steps ecessary to the occasion, Lieutenant overnor Patterson then turned to e railroad representatives present id said: 'In accordance with the reement between the California Toll ridge Authority and Interurban Elecic Key System, and Sacramento orthern, I formally place the use of ese railway facilities in the hands representatives of the railroads here day. I am certain, gentlemen, that will be your policy to operate these facilities to the best interest of the public.'

"A. T. Mercier, President of Interurban Electric; Alfred J. Lundberg, president of the Key System, and H. A. Mitchell, president of Sacramento Northern, then formally accepted the use of facilities for their companies.

"C. H. Purcell, Chief Engineer of the Bay Bridge and its railway facilities . . . said: 'Into this project have gone the skill and experience of the engineering profession—civil, electrical and mechanical. Great praise is due the staff of engineers employed by the State Department of Public Works on design and in the field. Also to Bridge Engineer Charles E. Andrew and to Engineer of Design Glenn B. Woodruff, who worked faithfully, conscientiously, and ably, special praise is due.'

"Ceremonies were held in front of the newly completed terminal building facing Mission Street in San Francisco with more than 1,500 dignitaries from cities of northern California, Alameda and San Francisco Counties participating before a great throng of citizens (more than 5,000) who came to witness the epochal event."

Returning to the present (January-February 1964), this once highly useful system has given way to a $35,000,000 bridge reconstruction program which began in 1957, removing the Key System rails and substituting motor coaches; and converting the double-deck bridge to provide five lanes of westbound traffic on the upper deck and five lanes of eastbound traffic on the lower — a changeover which became effective October 12, 1963.

Several additional contracts will conclude the huge project. One of these, awarded in December 1963, is for cleaning and painting concrete and structural steel, and resurfacing passenger loading platforms in the Transbay Transit Terminal Building, which now serves transbay bus operations.

Two forthcoming contracts will provide modernization in the way of installing more call boxes for both spans, and for resurfacing the bridge's lower deck.

Norman B. Deuel

Norman B. Deuel, information officer I with the Division of Highways, died on November 12 after a brief illness.

He joined the division in 1953 after a long career as a newspaperman.

Born in Chico, Deuel was the son of the late State Senator Charles H. Deuel, after whom the Deuel Vocational Institution at Tracy is named.

He attended local schools in Chico and Stanford and Columbia Universities, after which he worked for several newspapers in California.

He had experience as a newspaperman in Paris and other European points before joining the United Press as wire editor and reporter. He served as UP correspondent in Moscow from 1936 to 1940 and covered the Russo-Finnish War in 1939.

In 1941 he joined the federal government as a news analyst and during World War II was a Navy officer attached to the embassies in London and in Ottawa, Canada, where he was assistant naval attaché.

After the war he worked for several years on the Sacramento *Union* as political editor before joining the State.

One of his assignments with the *Union* was a series of articles on the Mother Lode country. He retraced this last summer for an article on State Sign Route 49, the Mother Lode Highway, which appeared in the July-August 1963 issue of *California Highways and Public Works* under the title "Highway Through History."

Deuel was a Mason and a member of the State Mens Club and the Sacramento Public Relations Round Table.

He is survived by his wife, Frances, an employee of the State Department of Education.

Traffic records on the bridge continue to set new highs. The average daily traffic in 1963 was 119,506 vehicles per day which represents a 20-percent increase over the daily traffic count of 99,597 for the year 1958.

Three Highway Supers Join Retired Ranks

Three long-time highway maintenance superintendents of the Division of Highways have retired from state service.

They are: Oscar Beach, of Chico, 39 years with the division; Charles L. Biggs, of Santa Maria, 42 years; and Adam Franklin Jeffrey, of Porterville, 40 years.

Beach has been in charge of the Chico maintenance territory for the past 12 years.

Born and educated in Delta, Colorado, he worked for the highway departments in Colorado, Arizona and Nevada before joining the California Highway Division.

He was advanced to foreman in 1927 and to superintendent in 1951.

Beach and his wife, Gwendolyn, have five children and eleven grandchildren.

Born in Santa Cruz, Biggs attended El Centro High School in San Diego and entered state service at Fairfield. He has been stationed in Madera, Delano and Brea, was promoted to superintendent at Red Bluff and transferred to Santa Maria in 1952.

Biggs served with the Seabees in England and Africa during World War II.

Biggs and his wife, Erin, have a son, Edward.

Biggs is a Mason. His retirement plans include a trip to Spain and work with the YMCA.

Jeffrey started his career as a truck driver for District VI in 1923 and was a member of the crew that laid the first oil on the Merced County side of the Pacheco Pass.

He was promoted to foreman at Midpines (seven miles east of Mariposa) in 1928. Later assignments took him to Bakersfield, Porterville, Madera, Lemoore and Fresno. He received his permanent appointment as superintendent at Porterville in 1948.

Jeffrey and his wife, Erma May, plan to do some traveling after his retirement. They will maintain their home in Porterville.

Low Bid on Bonds Accepted by CTBA

The California Toll Bridge Authority on October 23 accepted the low bid submitted by a group of four underwriting firms represented by Blyth and Company, San Francisco, for $75,000,000 in refunding bonds on the Carquinez Strait Toll Bridges.

The successful bid involved a net interest rate of 3.6273 percent, which was estimated by the authority's financial consultants as amounting to a saving of almost $1,000,000 in interest costs over the life of the bonds in comparison with the original bonds issued in 1955 and 1959 to finance construction of the parallel Carquinez Bridge and the Benicia–Martinez Bridge.

The only other bid submitted was that of a group of firms headed by F. S. Smithers and Company of New York City, whose offer involved a net interest rate of 3.6464 percent.

Part of the funds from the new bond issue will be used to realign and reconstruct the present two-lane State Highway 21 for 12 miles between Benicia and Interstate 80 near Cordelia as a four-lane divided highway serving as an approach to the Benicia–Martinez Bridge.

Governor Edmund G. Brown (Chairman of the Toll Bridge Authority) presided at the bid-opening meeting.

Cost Index Shows 2.6 Percent Drop

The California Highway Construction Cost Index for the fourth quarter of 1963 stands at 243.0 (1940 = 100), a decrease of 6.5 points or 2.6 percent under the third quarter of 1963.

The index for the year 1963 has been computed at 246.8, 9.4 points or 3.7 percent lower than the figure for the year 1962.

The quarterly and yearly indices confirm the prevailing trend of stability in highway construction cost. This trend is also indicated nationwide by the small fluctuations in the Bureau of Public Roads Highway Price Index during the past 12 months.

Governor Appoints Scenic Committee

Governor Edmund G. Brown has appointed a seven-man advisory committee on a master plan for scenic highways created by the Legislature at its last session. They are:

Nathaniel Owings, of Big Sur, internationally famed architect whose designs include the Lever House in New York City and the Town of Oak Ridge, Tennessee.

Edwin S. Moore, of San Francisco, executive vice president of the California State Automobile Association.

Robert Grunwald, of Hanford, an expert in city and regional planning, community development and head of a landscape architecture firm.

Richard Leonard, of San Francisco, an active conservationist and for many years, a director of the Sierra Club.

Harry P. Schmidt, of Gustine, a Merced County Supervisor who has maintained a long-time interest in highway matters and scenic conservation.

Dee W. McKenzie, chief of the highways and bridges division of the County of Sacramento Department of Public Works and a veteran highway and bridge design engineer is chairman of the committee.

Charles P. Walker, of Manhattan Beach, is an engineer and economist who has served three terms as Mayor of Manhattan Beach and was 1961 recipient of the Earl Warren award for civic activities.

McKenzie, Schmidt, Walker, Moore and Grunwald served on a citizens advisory committee appointed by the Governor which helped pave the way for scenic highway legislation during the last legislative session.

"I consider this committee one of the strongest tools we have in the task of creating a network of scenic highways which will preserve and enhance the great heritage of natural beauty in California," the Governor said.

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Liberated' - Ferry

Photo right: Ready for another trip across Cache Slough. The Real McCoy loads trucks and passenger cars in her new ferry slip. Slip was not needed when the vessel operated on a cable.

The Real McCoy, before conversion to free running, operated on a cable across Cache Slough. It was necessary to remove the cable for operation of the Sacramento-Yolo Port District's deep-water channel.

After nearly 20 years as a captive, cable-operated vessel, the *The Real McCoy* began a new career August 27 as a free-running ferry. It operates on Cache Slough from the mainland near Rio Vista to Ryer Island.

Entirely refurbished and gleaming in white paint, *The Real McCoy* now is diesel-powered, steered and driven by propellers amidship on both sides. It is equipped with modern appurtenances, including radar.

Conversion of the vessel was necessary so that the cable formerly used across Cache Slough could be removed for operation of the Sacramento-Yolo Port District deep water channel. The cost of approximately $96,600 was met by the port district under agreement with the Department of Public Works.

It was also necessary to construct ferry slips and fenders to accommodate the free-running ferry. This was done under separate contract.

During conversion the ferry *Scooter*, a reserve cable-operated vessel, maintained service. The conversion was done under contract by Colberg, Inc., Stockton.

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At left is photo in recent times of old San Fernando Pass. Walls are remarkably stable. Once a toll road, charges were $2.50 for a 12-horse team, 25 cents for a horse and rider, 10 cents for miscellaneous arrivals, and 4 cents each for sheep. Above and below are pictures of various traffic problems experienced in negotiating old Newhall Tunnel, which was only 17½ feet wide and 17 feet high at center. Dark, low, and narrow, it was difficult for trucks—virtually a one-way proposition—and fearsome for passenger cars which sometimes turned out heavily on weekends for wildflower viewing or other recreation.

EVOLUTION OF A PASS

According to the *Southern California Historical Society Quarterly*, the first cut was made in the old San Fernando Pass in 1854 to improve a wagon road of sorts, and it was cut deeper in 1858 for the Butterfield Stages. It was further deepened in 1862 by General E. F. Beale, owner of the huge Rancho Tejon, who repaired the route and reopened it as a toll road between the San Fernando and San Joaquin Valleys. With the completion of the railroad in 1870, wagon traffic fell off rapidly, and the county fell heir to the road in 1883.

The first automobile went over the pass in 1902, an "Autocar" driven by Los Angeles dealer Ralph Hamlin, accompanied by the new owner from McKittrick, who had come by train to pick up his car. The grade was so steep gasoline would not flow to the carburetor and they had to climb in reverse, both men leaping out and chocking the wheels with rocks each time the engine stalled.

In 1904, to lessen the grade, men with picks and shovels once more laboriously deepened the cut, and the

(Continued on inside back cover)

California Highways and Public Works

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FRONT COVER: *As the new numbering system for California State Highways goes into effect, Francis (Mickey) Johnson (right), Highway Maintenance Man III, and Blas Gonzales, Highway Maintenance Man I, both from District VII Sign Maintenance Station, raise new sign shield on coastal route just south of Point Mugu in Ventura County. Route, once known as "The Roosevelt Highway," was previously numbered U.S. Highway 101 Alternate, is now a part of State Highway Route 1. See "Route Renumbering," page 11.* (Photo by Peter Asano.)

BACK COVER: *View of Santa Barbara and newly completed freeway section of U.S. 101 angling in from upper left. Santa Barbara Yacht Harbor in foreground, with city center and State Street right center. City owns virtually entire waterfront, and preserves it as a public park. Dark mass extreme right center is famous Moreton Bay Fig, largest of its species in U.S. Freeway routing passes just to north of it. See "Santa Barbara Freeway" page 2.* (Photo by Robert Rose.)

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Santa Barbara Freeway

By J. M. STURGEON, District Construction Engineer

Santa Barbara, with its Spanish background and character, has been regarded as a city blessed with an abundance of scenic ocean and mountain views, an excellent climate, and widely accepted as the center of a resort and retirement area that is among the best California offers.

While still considered a resort center, Santa Barbara, with 64,000 people, is now classed as one of the 11 "urbanized areas" in the State.

Santa Barbara has become an education center with the Goleta Campus of the University of California adjacent to its west city limits, Santa Barbara City College inside the city, and Westmont College just south of the city in picturesque Montecito.

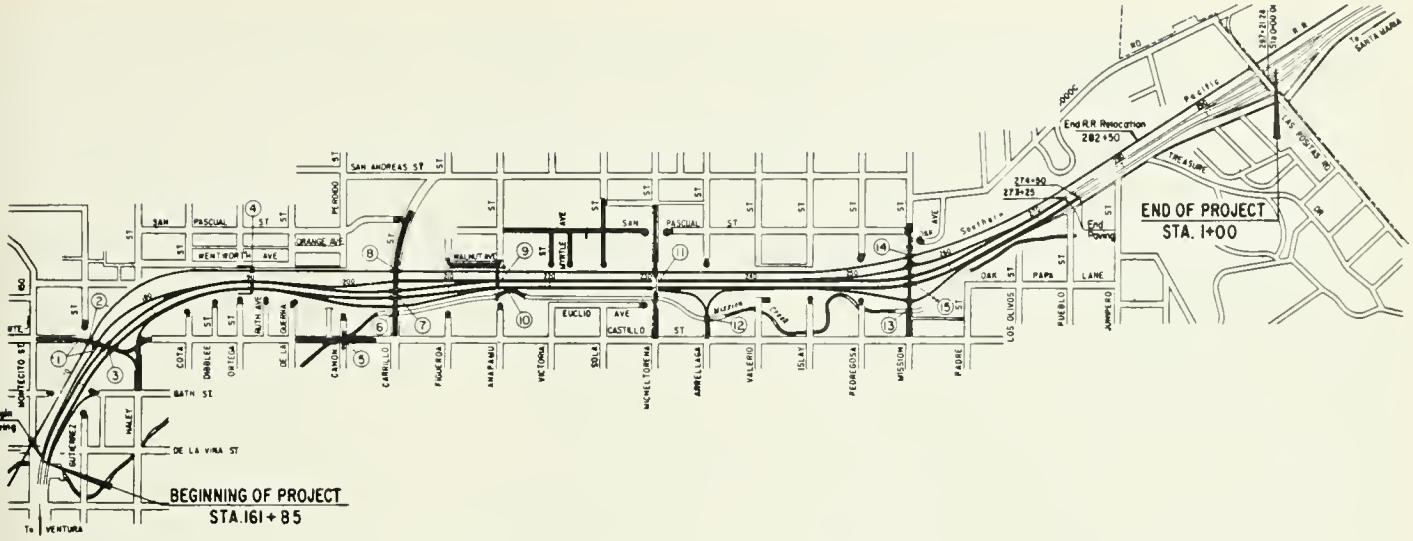
Growth of Industry

Research centers for a number of industries have established themselves in and around Santa Barbara, as have a number of electronic and space age industries.

Since World War II, realignment, reconstruction, upgrading and improvement projects have followed each other in a steady procession in and around Santa Barbara on U.S. 101 to meet ever-changing traffic needs caused by the growth and development of this area.

By the fall of 1961, this highway had been constructed to full freeway or well-developed expressway standards from the junction of the Ventura-Santa Barbara county line to the town of Buellton in the Santa Ynez Valley, some 50 miles north of Santa

This aeriol of the Castillo Street undercrossing (near completion) shows the routing of traffic to the northbound lones while the southbound lane is being finished. It also shows some of the railroad relocation in the curve of the left.



This project map from the specifications book shows the routing followed by the freeway through the City of Santa Barbara. Numbers refer to various structures.

Barbara, except for a very significant ½-mile stretch running along the west side of downtown Santa Barbara.

There, between the intersection of De La Vina and Montecito Streets to the southeast and Pueblo Street on the west, traffic was still using a narrow four-lane facility built in 1934. Though some shoulder paving and widening have been accomplished since to provide four full-traffic lanes, the 40-foot-wide original construction was no match for the traffic it had to handle.

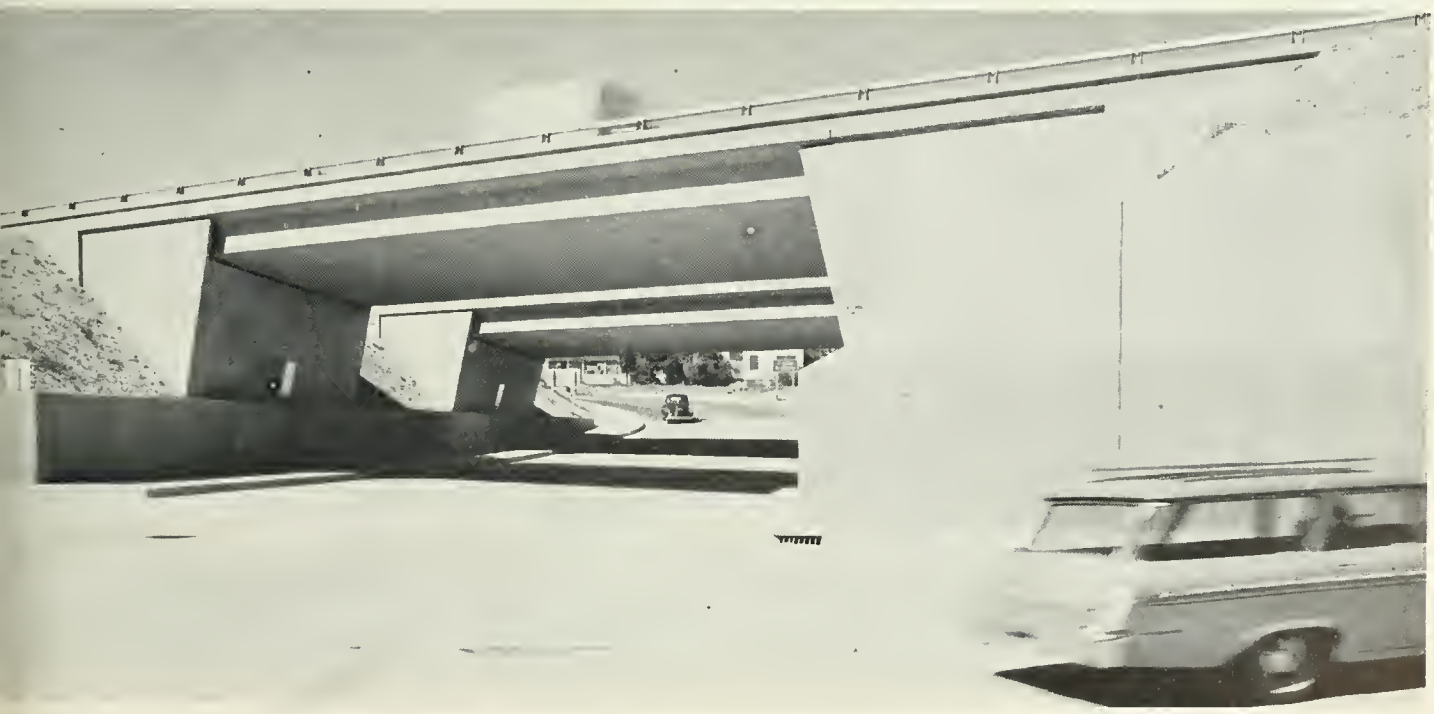
Big Traffic Increase

In the eight years between 1954 and 1962 peak traffic on this section of highway jumped 85 percent, with figures now indicating better than 39,000 vehicles per day. Traffic congestion increased to the point that cross traffic, which had also increased considerably in volume, could no longer be handled efficiently even through signalized intersections. Delays and hazards increased beyond tolerable limits.

Freeway design plans that had been developed for some time were quickly brought to completion, bids were called for, and on November 9, 1961, work on this $5,000,000 project was begun by Gordon H. Ball, Gordon H. Ball, Incorporated, and Talbot D. Bailey, Incorporated, contractors operating as a joint venture.

The contractors were faced immediately with some serious problems of how to phase their construction work.

The entire alignment to be constructed was complicated by controls and restrictions that were a designer's dilemma. To the south the main line



The Costillo Street undercrossing, giving a detailed view of the "boat" section described in the article.

Looking west at the Anapamu pedestrian overcrossing in front of the Wilson Elementary School.

The Mission Street railroad bridge (foreground) and the undercrossing (background) looking in the direction of the City of Santa Barbara.

of the Southern Pacific Railroad's coast route restricted expansion. On the north, Mission Creek, the main drainage channel for the older section of Santa Barbara, paralleled the existing alignment.

After considerable study, it was finally determined that portions of both Mission Creek and the railroad would have to be relocated to provide space for the fully developed freeway needed in this area.

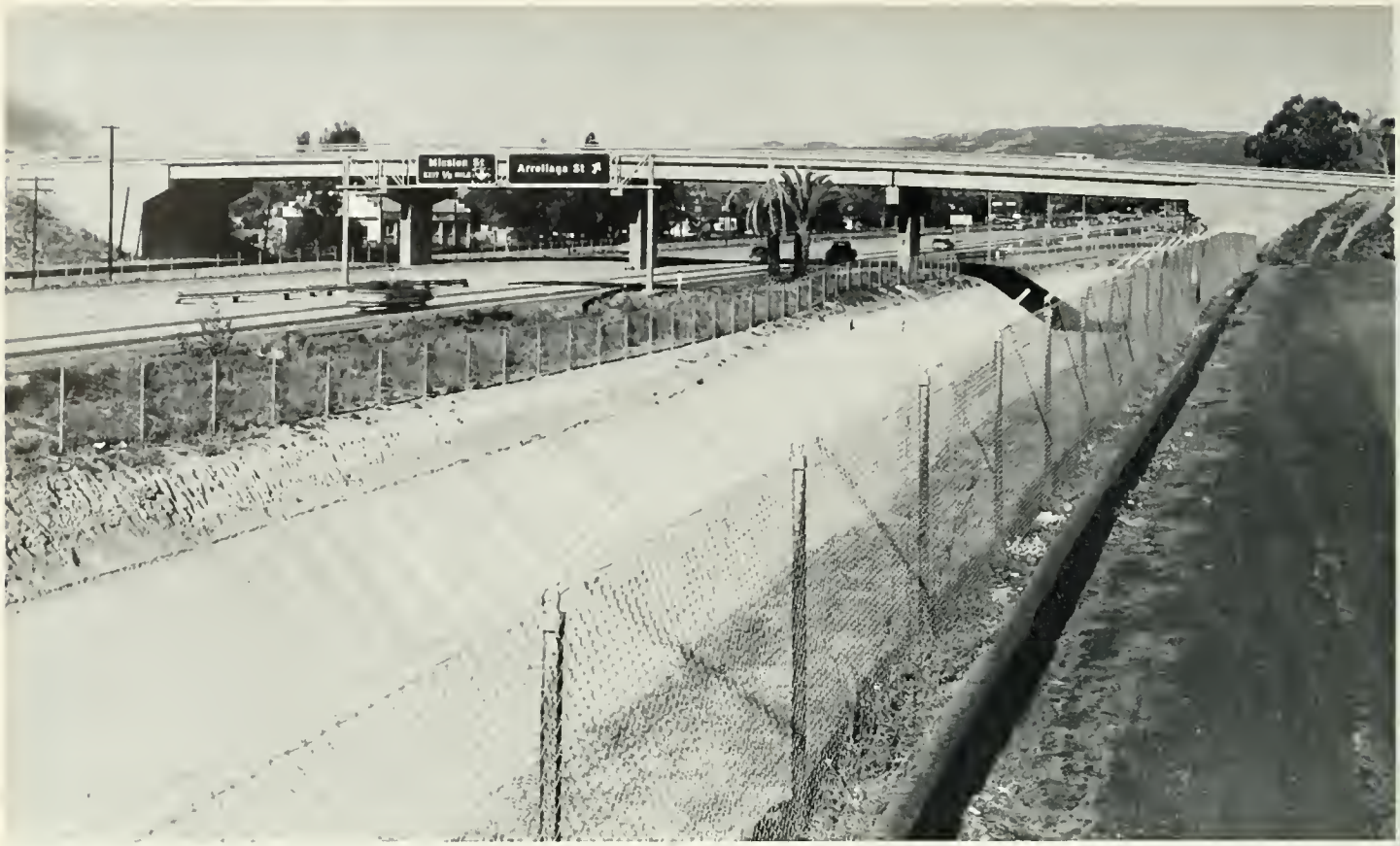
Even though room was provided for the freeway, there still was not sufficient area to build the project without inconvenience to traffic. For example, new lanes had to be constructed over existing lanes in many places, with traffic maintained on existing lanes until the new lanes were completed.

Extensive Studies Made

During the planning stage, extensive studies had been made evaluating the idea of detouring traffic over city streets while freeway construction was underway. These studies showed that this would be extremely costly, and in addition, would have spread congestion and accompanying traffic hazards over a distance three times the length of the construction project. It was concluded that the least cost and inconvenience to the traveling public would occur under the conditions providing for traffic to be narrowed down to two of the existing lanes in the construction area, then to construct two new lanes, transfer traffic to them, construct the second pair of new lanes, and then split traffic to the four completed lanes.

Stage construction and traffic shifts did not stop then, however. Construction of interchange structures involved cross streets, either over or under the railroad tracks as well as over and under the freeway itself. In two instances, underpass construction meant that a "shoofly" had to be contructed to detour railroad traffic around the proposed excavation area. The cross street then had to be excavated and a new railroad bridge built. After that, the "shoofly" was eliminated, railroad traffic routed over the new bridge, and the remainder of the excavation and interchange construction completed.

n aerial of the freeway area through Santa Barbara. The sand dredge is in the foreground with the Marina to the left. The Moreton Bay fig tree is right middle ground with the central business district beyond and to the right of the tree.



The Mission Creek channel change parallels the freeway to the right beginning left foreground. The Southern Pacific Railroad is on the other side of the freeway. The view is westward toward the Micheltorena Street overcrossing.

Stage Construction

All these stage construction requirements eliminated any possibility of high production rates in connection with any of the contract items. Consequently, it is of interest to note that the contractor elected to mix and place the portland cement concrete pavement with a Gunnert-Zimmerman slip-form paver in combination with tilting-drum transit mixers. Contractor Gordon H. Ball has been a pioneer in the development and use of this specialized equipment which has proven so successful in rapid discharge of low-slump concrete. Figures indicate that with the relatively short runs that were possible at any time, and even though two complete "move-ins" and "move-outs" of equipment were involved, this was the contractor's most economical alternative.

The job feature that may be of greatest interest to both design and construction engineers involves the Castillo Street Interchange near the southeasterly end of the project. Design and space limitations required that Castillo Street go under the freeway and adjacent railroad tracks, even with the knowledge that a high water table existed in this area.

As a solution to this high water table problem, it was decided to construct a "boat section" which in effect meant construction of a concrete boat in place that would neither float up nor sink as the water table rose and fell.

Final plans called for Castillo Street under the freeway area to be held down in the area of deepest excavation by some 500 piles driven in place.

Romps Weighted Down

In addition, for approximately 150 feet outside the area locked in place with the piles, Castillo Street and the interchange ramps were weighted down with extra-thick concrete pavement, sometimes as much as five feet thick, and at the ends of the sections at least one foot thick.

This meant that all excavating, pile driving, concrete work and other operations had to be carried on within an extensive system of well points that were under continuous pumping to assure a dry working area.

With all these problems, the contractor remained on schedule and the project was completed on January 3, 1964, some 30 years after the completion of the highway it replaced.

Key personnel included Jay Row, project superintendent for the joint venture; Talbot Bailey, Jr., project engineer; Al Banducci, bridge superintendent; and William Appel, paving superintendent. J. Arthur Case, Santa Barbara County flood control engineer, represented county interest on the Mission Creek realignment work and W. W. Wills, public works director for the City of Santa Barbara worked closely with state and contractor's representatives through all phases of the work.

J. B. Popnoe was resident engineer for District V, and P. G. O'Halloran was Bridge Department representative State Division of Highways.

Morongo Canyon

New Freeway Section Has Rest Area and Fountain

By C. F. "BING" JOHNSON, Resident Engineer

Few people in the United States, or even in California, had heard of Morongo Valley until 1909.

In that year in Banning, a 25-year-old Piute Indian, Willie Boy, kidnaped his sweetheart, Isoleta Boniface, after having put a bullet through her father's head, and dragged her into Morongo Valley in an attempt to escape the law. The newspapers all over the country carried the story of his manhunt in their headlines. Willie Boy realized that Isoleta was slowing down his progress in keeping ahead of the sheriffs of two counties and their posses, so he killed her and pushed on alone. For two weeks, he hiked through the rugged mountains of the high desert from Banning nearly to Ludlow, 70 miles northeast of Banning, and back to the Morongo Valley area 25 miles northeast of Banning, but the expert trackers following were too much for him. They found his body near what is now Pioneer Town, where he had shot himself with his last round of ammunition.

First White Settler

The first white settler in Morongo Valley, Curtis Christiansen, came in 1874 and fashioned a crude home for his family in Little Morongo Canyon. Prior to this date, Morongo Valley had been inhabited only by Piute and Morongo Indians.

Christiansen and his family saw occasional Spanish missionaries and prospectors use the road through the canyon. The road at that time consisted of two wagon wheel ruts worn in the sand.

More settlers followed Christiansen into the valley and started raising sheep and cattle. The ranchers and local freighters drove their teams and

The new Morongo Canyon Freeway with the old road and creek bed to the right.

A safety rest area and drinking fountain along the freeway.

Aerial view of the new freeway looking north up the canyon. Note the beginning of the project in the lower left. The community of Morongo Valley
the background.

vagons over the trail through Dry Morongo Wash. This trail was located on the easterly edge of the canyon. From this point northerly to the community of Morongo Valley, the old trail was about a quarter of a mile west of the alignment of the new roadway. It passed near the old Hole-in-the-Wall Spring one mile south of Morongo Valley, where travelers used to stop and water their horses and rest a bit.

The Hole-in-the-Wall Spring is an old mine tunnel which extended from the face of the decomposed granite hillside into the hill 60 feet. When the opening to the tunnel was dammed up, the water stood about two feet deep in it and it formed a nice underground storage reservoir.

Flood Danger

The road through Dry Morongo Canyon and Morongo Valley was a hot dusty trail most of the time, but during the summer season when those white billowing clouds known as thunderheads began to gather in the sky, prudent teamsters waited at Morongo Valley or at the mouth of the canyon until the clouds had blown away or until the floodwater had all run out of the canyon. It would have been disastrous to be trapped in the canyon with a five-foot stream of water flowing swiftly down it because there was no place to escape up the steep rocky canyon walls with a team of horses and a wagon.

The old wagon trail remained in existence until 1937 when it was paved with road-mixed asphalt surfacing. During the flood in the spring of 1938, the water ran five feet deep down the canyon, according to long-time residents in the area, and washed out most of the new asphalt surfacing. It was replaced and it remained with only minor maintenance until construction of the new roadbed in 1963.

Selected Rock Gives Protection

The new roadbed was constructed on the westerly side of the canyon with the finished grade a minimum height of five feet above the flowline of the canyon; however, throughout most of the canyon the height is 10 feet or more. The entire right side of the roadbed embankment from 1,000

Approaching the safety rest area about halfway through the canyon.

An aerial view of the freeway looking southeast down the canyon. Note the bridge in the foreground.

An aerial view northward across the community of Morongo Valley. The bridge can be seen left foreground and just beyond, the safety rest area and drinking fountain.

feet north of the beginning of the project to the bridge at the county line is lined with selected rock slope protection obtained from the rock cuts. The selected rock slope protection was placed on the outside edge of the fill slope five feet thick from a depth five feet below the existing sandy floor of the canyon to a planned profile grade which was 5 feet to 10 feet above the elevation of the canyon floor.

At particularly vulnerable locations on inside curves where a heavy flow of storm water with high velocity would be directed toward the embankment, the selected rock slope protection was "beefed up" with additional thickness of rock above the existing ground line in order to provide increased protection againsr extreme flash floods.

The contractor, E. L. Yeager Company, began work on January 8, 1963, and his fast progress kept the work well ahead of schedule on the 175-day contract until August.

During construction, traffic was kept on the old road through the canyon portion of the job. At the county line, traffic was detoured westerly under the Dry Morongo Wash Bridge while the bridge was under construction, and thence to the connector road which was constructed early in the contract in order to get the traffic out of the way of new construction between the bridge and Station 45+00. The connector road will now become a county road to serve residents in Dry Morongo Wash. From there on northeasterly through the community of Morongo Valley, traffic was carried through new construction.

Flash Flood

On the evening of August 7, 1963, a sudden two-inch rain caused a flash flood in the canyon, which pushed 6 to 12 inches of rocks and sand upon the old road in some places and washed out the shoulders two to three feet deep in other places. Traffic was quickly switched onto the uncompleted new road under pilot car control for a night and a day while the debris on the old road was cleaned up.

No damage resulted on the new roadway from the flash flood.

On the afternoon of August 29, 1963, the old road was again closed, due to a vehicle accident which damaged the falsework under the bridge. It took a week for the contractor to untangle the wreckage under the bridge and remove all of the damaged falsework so that he could get traffic back on the old road and proceed with completion of the new road. It had been his plan to leave all of the falsework under the bridge intact until after the traffic had finally been switched to the new roadbed permanently. The falsework could then have been removed with no interference with the public traffic on the detour through the falsework under the bridge.

The project developed 50,000 cubic yards of excess roadway excavation over the 707,000 cubic yards which would have been required for construction of the planned embankments. Some of this excess material was used to widen the shoulders in four locations, in addition to the four locations called for on the plans, from four feet to eight feet in order to provide additional emergency parking off the traveled way. The remainder of the excess material was disposed of on the right and left sides of the roadbed one-quarter mile north of the bridge. These widened areas were then paved to provide for emergency parking and safety roadside rest areas. A drinking fountain with a hydrant for filling water cans was constructed on each of the safety roadside rest areas on the steep mountain grade. Water for the fountains comes from the Hole-in-the-Wall Spring referred to above.

Two additional paved emergency parking areas were developed by daylighting cuts.

Route Renumbering

New Green Markers Will Replace Old Shields

New white-on-green route markers re replacing the familiar black and white shields along some of California's state highways.

Fewer than 50 routes will be affected in the immediate future, although a general renumbering of state highways has taken place in accordance with legislation (Senate Bill 64, Collier) that became effective on September 20, 1963. Where possible, state highways have retained their posted numbers, so that many existing black-on-white markers will remain in place for a while.

Confusion Possible

Some confusion on the part of drivers traveling reposted roads is expected for the next several months. The primary reason is the fact that automobile clubs and the commercial mapmakers, whose products are dispensed by oil companies and others, could not note the new route numbers on maps printed prior to this time. Maps being prepared now will coincide with the new signs.

Another source of possible confusion stems from the fact that the federal government has designated some highways in California by numbers already in use by the State. The State immediately changed its numbers to avoid duplication. Again, maps now on drawing boards will note the changes.

Spade Design Retained

The new markers, like the old sign route shields, are in the shape of the spade used in the gold fields by California's 49er miners. Designed to last for many years, they are cut from aluminum. Their white numerals and translucent green background are developed through a reverse screening procedure. The combination is designed to retain a high degree of visibility at night and in hazy weather.

The colors were decided upon after a panel of engineers had checked various color combinations in over-the-road tests. Blue and gold were strong contenders but lost out when it was discovered the gold had a tendency to appear muddy at night while the white and green retained their true hues.

With the advent of the white-on-green signs some long-familiar numbered routes are being lengthened (Route 1's southern terminus will be Capistrano Beach, Orange County, instead of Las Cruces, Santa Barbara County); some are being shortened (Route 99's new temporary terminus will be Los Angeles instead of the Mexican border at Calexico); and some will be eliminated (U.S. 399).

History of Route Markers

The black-and-white color combination was first adopted by the federal government in 1926 but the first route markers did not appear along California highways until January 1928. However, the Division of Highways was not assigned responsibility for signing highways until 1934, and during the intervening six years two major automobile clubs carried out the program at their own expense.

The California State Automobile Association placed signs in the 45 northern counties, and the Automobile Club of Southern California provided similar service in the 13 southern counties. This work was undertaken along U.S. highways, state highways, county roads and city streets.

The first road to be marked in the north was U.S. 40 from Berkeley to the Nevada state line. In the south, U.S. 101 from Los Angeles to San Diego was marked at the same time. The black-on-white signs were rectangular in shape.

A short time after the automobile clubs began installing signs, the American Association of Highway Officials published the *Manual on Uniform Traffic Control Devices*. The manual established standards in the marking and positioning of U.S. route markers. When the Division of Highways undertook the responsibility of signing highways, it was decided to examine the routes signed by the auto clubs and bring their signing to conformance with AASHO standards.

Because U.S. highway markers were not appropriate for marking state routes, Division of Highways engineers met with representatives of the two automobile clubs to adopt a route marker for state highways. After examining a wide range of suggested designs, the group selected the "bear shield" which resembled a miner's spade and displayed a grizzly bear taken from the California Bear Flag.

Numbering Systems Vary

As the state highway network grew and existing roads became longer, each new segment was given its own number by the Legislature then in session. As a result, some state highways acquired as many as 13 different legislative route numbers along the way. To minimize these complications for the motorist, the Division of Highways established the state sign route system that identified each road from one end to the other by a single number. This system supplemented the U.S. shield numbers which are assigned by the federal government on the recommendation of AASHO.

The new system parallels the sign route method in that one road calls for only one number when possible.

Sign Installation Schedule

Some of the new route signs are already in place, and Division of Highways plans call for almost all those which will identify the renumbered highways to be installed by July 1, 1964.

More signs will be posted during the next two or three years. Damage and age will necessitate future replacement of present black-on-white markers. And where highway construction is underway or will begin in the near future, state officials believe it impractical to post new signs along a right-of-way until construction is nearly complete.

Another important facet of the operation is the removal of black-and-white shields. In the past, portions

of many California highways have been marked with the shields of multiple routes because those particular stretches were incorporated into a combination of two or more state and federal highways. This practice, which complicated travel for unwary drivers unacquainted with the procedure, will almost be eliminated when the "one number equals one highway" project is complete.

Interstate Route Signs Differ

Routes that make up the California portion of the National System of Interstate and Defense Highways are locations where the new numbers will receive a prominent display but on red, white and blue shields instead of white on green. Typical examples are Interstate Route 80 between San Francisco and Reno (formerly U.S. 40), and Interstate Route 10 between Los Angeles and Indio (formerly U.S. 70, 99, and portions of 60).

These multilane full freeways and other interstate routes will proclaim their route numbers in red, white and blue on route signs that resemble the federal shield. The variations in color and design will make any road that is part of the national interstate system easy to identify as such.

Not all the black-on-white federal shields will disappear from national highways in California, for the red, white and blue shields will mark only interstate routes. Those U.S. highways (U.S. 101, for example) which are not included in the national interstate system will retain their present black-on-white shields.

Nor will the blue-and-gold shields that identify county roads by letter and number be eliminated. The county networks were not included in the 1963 legislative act and therefore will retain their present identities and shields.

Renumbered State Highways

The following list includes all California state highways where new signs will be posted over any portion of their length prior to July 1, 1964.

Route 1—742 miles, from Interstate Route 5 at Capistrano Beach, Orange County, via San Luis Obispo, San Francisco and Jenner to Fernbridge, Humboldt County. Incorporates former U.S. 101 Alternate from Capistrano Beach, Orange County, to north of Oxnard, Ventura County.

Route 2—89 miles, from Route 1 in Santa Monica to Route 138 near Cajon (north of San Bernardino). Incorporates portion of former U.S. 66 between Santa Monica and Pasadena.

Route 4—209 miles, from Interstate Route 80 near Hercules, Contra Costa County, via Angels Camp, Calaveras County, to Route 89 at Woodfords, Alpine County. Incorporates former Route 24 from Concord, Contra Costa County, to Antioch Bridge, Contra Costa County.

Route 7—33 miles, from Route 11 (Harbor Freeway) in San Pedro, Los Angeles County, to Interstate Route 210 in Pasadena. Incorporates former Route 15 for length of Long Beach Freeway.

Route 11 (Harbor and Pasadena Freeways)—33 miles, from San Pedro, Los Angeles County, to Route 248 in Pasadena. Incorporates former U.S. 6 from San Pedro to Los Angeles and former U.S. 66 from Los Angeles to Pasadena.

Route 14—141 miles, from Route 1 northwest of Santa Monica to Route 395 near Inyokern, Kern County. Incorporates Antelope Valley Freeway and former U.S. 6 from junction with Route 395 at Tunnel Station (north of San Fernando, Los Angeles County) to near Inyokern. (Santa Monica to Tunnel Station not yet constructed.)

Route 26—56 miles, from Route 99 near Stockton to West Point, Calaveras County. Incorporates former Route 8 from near Stockton to Mokelumne Hill.

Route 29—107 miles, from Interstate Route 80 near Vallejo, via Calistoga, Napa County, to Route 20 near Upper Lake, Lake County. Incorporates former Route 53 from Middletown to Lower Lake, Lake County.

Route 33—315 miles, from Route 101 near Venture via Coalinga, Fresno County, to Interstate Route 205 near Tracy, San Joaquin County. Incorporates former U.S. 399 from Ventura to Taft, Kern County.

Route 35—52 miles, from Route 17 near Holy City (Santa Cruz–Santa Clara county lines to Route 280 in San Francisco). Incorporates former Route 5 from Saratoga Gap, Santa Clara County, to San Francisco.

Route 37—32 miles, from Route 17 near Nicasio, Marin County, to Interstate Route 80 north of Vallejo, Solano County. Incorporates former Route 48 from junction with Route 37 at Sears Point, Sonoma County, to junction with Interstate Route 80. (Novato to Nicasio not yet constructed.)

Route 38—59 miles, from Interstate Route 10 near Redlands, San Bernardino County, to Route 18 at west end of Big Bear Lake, San Bernardino County. Incorporates former portion of Route 18 from west end of Big Bear Lake to Big Bear City.

Route 41—188 miles, from Route 1 near Morro Bay, San Luis Obispo County, via Fresno to the south boundary of Yosemite National Park. Incorporates portion of U.S. 466 from near Morro Bay to Atascadero, San Luis Obispo County. (See Route 46.)

Route 46—119 miles, from Route 1 at Cambria, San Luis Obispo County, to Route 99 at Famosa north of Bakersfield. Incorporates portion of U.S. 466 from point near Shandon, San Luis Obispo County, to Famosa. (See Route 41.)

Route 58—240 miles, from Santa Margarita, San Luis Obispo County, via Bakersfield, to Interstate Route 15 near Barstow, San Bernardino County. Incorporates portion of U.S. 466 from point near Bakersfield to Barstow.

Route 69—44 miles, from junction with Route 198 (near Exeter), Tulare County, to Sequoia National Park (north of Badger). Replaces Route 65.

Route 70—182 miles, from Route 99 (about 4 miles southeast of Nicolaus), Sutter County, to Route 395 near Hallelujah Junction, Lassen County. Incorporates former Route 24 from near Sacramento to Marysville and U.S. 40 Alternate from Marysville to Hallelujah Junction.

Route 82 (El Camino Real)—57 miles, from Route 101 at Ford Road (south of San Jose), Santa Clara County, to San Francisco. Incorporates former portion of U.S. 101 from Ford Road to San Francisco.

Route 86—89 miles, from junction with Route 111 (east of Heber), Imperial County, to junction with Route 10 near Indio, Riverside County. In-

corporates former portion of U.S. 99 from near Heber to near Indio.

Route 91—63 miles, from Route 1 near Hermosa Beach, Los Angeles County, to Route 395 near Riverside, Riverside County. Incorporates former Route 14 from Hermosa Beach to Route 5, former portion U.S. 91 from near Route 5 to Route 395.

Route 111—129 miles, from Mexican border at Calexico, Imperial County, to Interstate Route 10 near Whitewater, Riverside County. Incorporates former portion of U.S. 99 from east of Heber, Imperial County, to Calexico, Imperial County.

Route 113—60 miles, from Route 12 northwest of Rio Vista, Solano County, to Route 99 south of Yuba City, Sutter County. Incorporates former U.S. 40 Alternate from Interstate Route 80 near Davis, Yolo County, to south of Yuba City.

Route 116—47 miles, from Route 1 near Jenner, Sonoma County, to Route 121 near Schellville, Sonoma County. Incorporates former portion of Route 12 from Jenner to Schellville.

Route 119—34 miles, from Route 33 in Taft, Kern County, to Route 99 at Greenfield, Kern County. Incorporates former portion of U.S. 399 from Taft to Greenfield.

Route 121—34 miles, from Route 37, Sonoma County, to Route 128 north of Napa, Napa County. Incorporates Route 37 from junction with Route 48 at Sears Point to junction with Route 128 north of Napa.

Route 138—113 miles, from Interstate Route 5 near Gorman, Los Angeles County, to Route 18 near Crestline, San Bernardino County. Incorporates former portion of Route 2 from its junction with Route 138 east of Wrightwood to junction with Route 18 near Crestline.

Route 154—32 miles, from Route 101 near Buellton, Santa Barbara County, via San Marcos Pass, to Route 101 near Santa Barbara. Incorporates former portion of Route 150 from Santa Ynez to Route 101 near Santa Barbara.

Route 160 (River Road)—61 miles, from Route 4 near Antioch, Contra Costa County, to Interstate Route 80 near Sacramento. Incorporates former portion of Route 24 from Antioch to near Sacramento.

Route 175—38 miles, from Route 101 near Hopland, Mendocino County, to Route 29 near Middletown, Lake County. Incorporates former portion of Route 29 from Middletown, via Hobergs, to 5 miles south of Kelseyville.

Route 246—35 miles, from Surf, Santa Barbara County, to Route 154 near Santa Ynez, Santa Barbara County. Incorporates former portion of Route 154 from Surf to near Santa Ynez.

Route 299—307 miles, from Route 101 near Arcata, Humboldt County, to Nevada state line near Cedarville, Modoc County. Extends former U.S. 299 for 43 miles from Cedarville to the junction with Route 395 at Alturas, Modoc County.

ILLUMINATED SIGNS WARN OF FOG, LOW VISIBILITY

Signs which can be illuminated to warn motorists to reduce their speed to variable maximums at times of limited visibility, such as fog, have been installed at a test site on the Elvas Freeway (U.S. 99E) in Sacramento.

Ultimately, six signs on this freeway segment between Arden Way and south of the American River Bridge will be used to carry out part of the intent of Senate Resolution No. 33 (1963 session).

In this resolution, the Highway Transportation Agency was asked to initiate a "study which will determine possible means of giving advance warning to drivers of motor vehicles of the need for greater alertness and caution when driving during periods of reduced visibility." A report of survey findings will be submitted to the Legislature early in 1965.

The signs, electrically powered and comparable to the familiar time and temperature signs, will be in effect whenever weather conditions warrant reduced speed limits. Traffic engineers from the State Division of Highways will operate the signs in cooperation with the California Highway Patrol, and in turn survey their effectiveness in alerting the public to special hazards ahead.

The Senate resolution was enacted in an attempt to cope with accident statistics. Approximately 3 percent of automobile accidents in 1961 were attributed to conditions of reduced visibility. Moreover, 14 percent of 1961 accidents involving four or more cars happened under like conditions, and 1962 statistics showed that such accidents were increasing.

Variable speed signs are only one of the methods to be tested. Other devices and techniques being studied include increased patrol activity, concentrated public information dissemination, use of reflective wedge-shaped pavement markers, use of white shoulder stripings, and use of colored reflective shoulder and lane striping at on- and off-ramp locations.

State agencies involved in the study project are the Division of Highways, the California Highway Patrol, the Department of Motor Vehicles, and the Institute of Transportation and Traffic Engineering at the University of California's Richmond field office. The latter institution has made available their fog chamber for evaluating devices to be used in the study.

Hveem, Zube, Skog Win Emmons Award

Three Division of Highways engineers were recipients of the W. J. Emmons Award of the Association of Asphalt Paving Technologists.

They are F. N. Hveem, recently retired chief of the Materials and Research Department, Ernest Zube, supervising materials and research engineer, and John B. Skog, senior materials and research engineer.

The award was for the best paper presented at the 1963 meeting which was held in San Francisco.

Title of their paper was "Proposed New Tests and Specifications for Paving Grade Asphalts."

Zube and Skog also received honorable mention for a second paper presented at the same meeting.

District VII Progress

430 Miles of Freeway Now Open in Los Angeles Region

By E. T. TELFORD, Metropolitan District Engineer

In 1963 District VII completed and placed in service a record 54 miles of freeways, which added significantly to the effectiveness of the system in Los Angeles, Orange and Ventura Counties.

With 430 miles, or 27 percent of the planned network, in operation, gaps are being closed, longer continuous stretches of freeway are in use, traffic is spread more widely, and drivers have more choices of alternate routes. As the system grows, driving becomes easier and safer. This evolution will become more apparent each year until the entire 1,570-mile network is completed in 1980.

Although 1963 was a year of important freeway completions, there were some notable starts also, particularly the beginning of construction on the Pomona Freeway.

Some of the events that highlighted the year's work were:

—Completion of 54 miles of freeways, including 27 miles of interstate routes.

Two important Interstate freeways converge in the bare hills north of San Fernanda: the San Diego Freeway (Interstate 405) upper, and the Golden State Freeway (Interstate 5), and continue as Interstate 5 into the Tehachapi Mountains. This section of the Golden State and the connection with the San Diego were completed in 1963.

—Opening of the Vincent Thomas Toll Bridge linking San Pedro and Terminal Island.

—Completion of the San Diego Freeway for 43 miles from the northern terminus near San Fernando to Atlantic Avenue, southeast of the Long Beach Freeway.

—Completion of the Golden State Freeway for 25 miles from East Los Angeles Interchange through the San Fernando Valley to a junction with the San Diego Freeway near San Fernando.

—Completion of the Ventura Freeway through the City of Ventura.

—Santa Monica Freeway under construction from completed section at Vermont Avenue to western terminus in the City of Santa Monica.

—First 14.4 miles of the Antelope Valley Freeway opened.

—Start of construction on Pomona Freeway.

—San Gabriel River Freeway under construction for 12 miles between the San Bernardino and Santa Ana Freeways.

For the sake of simplicity and convenience, commonly used names of freeways are used in this report, although all are not official names. Route numbers used are those of the revised numbering system which becomes effective July 1, 1964.

Interstate System

Half of the 54 miles of freeway completed in District VII during 1963 was on routes of the interstate system. These 27 miles represented a construction cost of $70,200,000.

Emphasis on early completion of the interstate system will continue in coming years. The district planning program for the 1964-71 fiscal years includes $354,000,000 for construction and $166,700,000 for acquisition of right-of-way to complete the remaining miles of new construction and 31 miles of widening on existing interstate freeways.

The seven interstate routes in District VII total 325 miles, of which 210 miles, or 64 percent, have been completed. There are 34 miles now under construction, of which 17.8 miles will be completed in 1964.

All interstate routings in the district have been adopted except for two sections of the Foothill Freeway, on which public hearings will be held before midyear.

Elevated roadways frame construction activity in the San Diego–Santa Monica Freeway interchange area. The Santa Monica Freeway, under construction from Los Angeles westward to Santa Monica, is expected to be completed to this point early in 1965.

Traffic Benefits

Completion of important links in the San Diego Freeway, Interstate Route 405, created a majestic sweep of 43 miles of continuous freeway from east of the Long Beach Freeway, through the Bay area, West Los Angeles and the San Fernando Valley to the junction with the Golden State Freeway, north of San Fernando. Of great importance also, was the completion of the Golden State Freeway, between Osborne Street and the San Diego Freeway, allowing continuous travel of some 25 miles, from the East Los Angeles Interchange to its junction with the San Diego Freeway.

Travel time savings as a result of these freeway openings are substantial. For example, a drive from Long Beach, via the Pacific Coast Highway and Sepulveda Boulevard, to the Golden State Freeway near San Fernando, formerly required 90 minutes. Using the San Diego Freeway, this same off-peak-hour trip can be made in only 55 minutes of comfortable and scenic driving on the almost 50 miles of freeway. Peak-hour travel time is about 72 minutes.

Although the last segment of the San Diego Freeway was not opened

The public building program in the Los Angeles civic center during the past 10 years has made some dramatic changes in the appearance of the area. For comparison, the above photograph was taken December 1953 and appeared in CALIFORNIA HIGHWAYS AND PUBLIC WORKS *in the September-October 1954 issue.* *(See next page.)*

This photo, token January 15, 1964, shows the addition of buildings in the mall area, which will extend up the hill from the city hall to the Department of Water and Power Building and the Music Center (left center). Along the sides of the mall are the County Hall of Administration and the County Courthouse. The area between them is being excavated for construction of an underground parking facility. (See previous photo.)

until late in 1963, its traffic volumes are in excess of 100,000 vehicles a day for the 32-mile stretch from the Harbor Freeway north to the Ventura Freeway.

The two completions on the Golden State Freeway, from Lankershim Boulevard to Osborne Street, and from Osborne to the San Diego Freeway, afforded time savings and badly needed relief to the streets in the San Fernando area. With 20,250 of the previous 31,200 vehicles per day removed from San Fernando Road, local service is improved, and through traffic moves unimpeded on the freeway.

Portions of the new district freeway mileages were so recently added that the full impact of the added community benefits are only beginning to be realized. New subdivision activity adjacent to newly opened freeway segments indicates again that fast, timesaving, economical and safe freeway routings are a paramount factor in the economic growth of an area.

The 4,000,000 vehicles in Los Angeles, Orange and Ventura Counties traveled approximately 13 *billion* vehicle-miles on state highways during 1963; almost 8 billion of these miles were logged on freeways, at tremendous savings to the public. Freeway travel affords relief and safety of such magnitude that these 8 billion miles of vehicle travel create a saving in operating costs of $85,000,000, $16,500,000 in accident costs, and $275,000,000 in time savings.

Traffic Diversion

The now familiar pattern of large volumes of traffic diverted from parallel streets to freeways came into being in a rather more complex fashion than previous years in the case of the San Diego Freeway, many miles long in the current completed phase, with the gaps closed in calendar year 1963.

By virtue of its length, it passes through diverse areas, i.e., industrial and residential, as well as the semi-rural mountainous area through the Sepulveda Pass. Additionally, this freeway travels generally in an east-west direction in the harbor area, but south to north past the International Airport, through West Los Angeles and the San Fernando Valley.

The wide variations in changes of street volumes are shown as follows: Near International Airport the San Diego Freeway runs parallel to Sepulveda Boulevard about one mile to the east. Prior to the freeway opening 55,000 vehicles per day passed through the Airport Tunnel; subsequent counts at the same point indicated 43,000 cars per day are still passing through. The relatively small difference is due not only to the considerable distance between Sepulveda Boulevard and the freeway, but also because of its proximity to a major airport and a highly developed industrial area.

Conversely, in the San Fernando Valley, north of Vanowen Street, the freeway is located approximately one-half mile west of Sepulveda. When the freeway was completed, traffic volumes on Sepulveda dropped from a previous 45,400 per day to 15,100 vehicles per day. In this case not only is the freeway relatively close to Sepulveda Boulevard, but, in this area a relatively large portion of the traffic consists of commuter trips. Such traffic is, of course, readily divertible.

Truck Traffic

Truck classification counts were made in 1963, the first since 1960. Although there are considerable differences in the truck volumes, these are generally attributable to realignment of highways, rather than to large changes in area development and traffic patterns.

This is to be expected since commercial truck traffic, in general, directly reflects economic growth rather than population relocation or expansion.

Currently observed truck percentages are as follows: Hollywood Freeway, 4 percent; Ventura Freeway (west of Hollywood Freeway), 6 percent; San Bernardino Freeway, 10 percent; Santa Ana Freeway, 8 percent; Harbor Freeway, 5 percent; Santa Monica Freeway, 5 percent; Golden State Freeway south of Tunnel Station, 10 percent; north of Tunnel Station, 20 percent; Long Beach Freeway, 10 percent; and San Diego Freeway, 6 percent.

Average daily traffic volumes of the District VII freeway network during 1963 indicated a general 4-percent increase over 1962.

The breakdowns at key locations on the various routes are as follows:

1963 AVERAGE DAILY TRAFFIC

Hollywood Freeway	
(Westerly of Four-Level Structure)	185,000
(South of Ventura Freeway)	98,000
Harbor Freeway	
(South of Four-Level Structure)	188,000
(At 30th Street Overcrossing)	193,000
(At Century Boulevard)	136,000
(At San Diego Freeway)	63,000
(At Pacific Coast Highway)	28,500
San Bernardino Freeway	
(East of Long Beach Freeway)	158,000
(West of Golden State Freeway)	78,000
Santa Ana Freeway	
(East of Rosemead Boulevard)	112,000
(West of Long Beach Freeway)	180,000
Pasadena Freeway	
(North of Four-Level Structure)	92,000
(North of Golden State Freeway)	86,000
Santa Monica Freeway	
(Santa Ana Freeway to Harbor Freeway)	112,000
Ventura Freeway	
(East of Hollywood Freeway)	50,000
(West of Hollywood Freeway)	157,000
(West of San Diego Freeway)	133,000
Golden State Freeway	
(West of Pasadena Freeway)	130,000
(North of East Los Angeles Interchange)	116,000
(North of Ventura Freeway)	95,000
Long Beach Freeway	
(At Pacific Coast Highway)	57,000
(South of Santa Ana Freeway)	89,000
(South of San Bernardino Freeway)	48,500
San Diego Freeway	
(West of Long Beach Freeway)	74,000
(At Harbor Freeway)	84,000
(At Olympic Boulevard)	125,000
(At Ventura Freeway)	105,000
Colorado Freeway	
(At Linda Vista)	28,000
Glendale Freeway	
(At Golden State Freeway)	35,000
Riverside Freeway	
(At Santa Ana Freeway)	50,000
Using Four-Level Structure during a 24-hour weekday	333,000

Average daily traffic figures do not tell the full story of high traffic volumes that occur on peak days or weeks. For example, the 1963 average daily traffic on the Harbor Freeway at the 30th Street Overcrossing was 193,000, but during the week of June 16–22 the average was 203,000, and on the peak day, June 21, the traffic count at that point reached the total of 225,780.

Bridge Projects

Highlight of the year was the opening of the Vincent Thomas Bridge across the entrance to Los Angeles Harbor between San Pedro and Terminal Island. It is the third largest suspension bridge in California, 6,060 feet long, and 185 feet above the water of the channel, completed at a cost of $21,000,000.

At 9.15 p.m., November 14, 1963, the Terminal Island ferry made its last scheduled trip, then a party of invited guests, including many public officials, went aboard for a tour of the harbor. At 12.01 a.m., November 15, a caravan of more than 100 automobiles crossed the bridge and returned to San Pedro, in celebration of the opening. Riding in the first car, and paying the first 25-cent toll was Assemblyman Vincent Thomas of San Pedro, for whom the bridge was named in recognition of his many years of activity on behalf of the crossing.

The Vincent Thomas structure was designed by the Bridge Department, California Division of Highways, and construction was in charge of the department's southern office in Los Angeles.

This office works closely with District VII in providing cost analyses of structures for route location studies. More than 2,200 such cost estimates were made in 1963. In the design stage, where more detailed information becomes available, estimates were given on 240 structures.

More than 190 highway structures were completed in the district during the year at a cost of $35,000,000.

This section of the Golden State Freeway, completed in 1963, forms a junction with the San Diego Freeway, upper right, and continues over the Tehachapi Mountains to the San Joaquin Valley. At the lower left is the connection for the Hollywood Freeway Extension, which will be built to this point within the next few years.

Route Planning

Approximately 380 miles of freeways, estimated to cost $2,270,000,000 for construction and right-of-way, were under active study for route adoption at the beginning of 1964. These projects include the only two segments of the interstate system in this district that remain to be adopted. Both are on the Foothill Freeway (Interstate Route 210). Public hearings are planned before mid 1964 on these sections:

Foothill Place to Hampton Road, 10.5 miles.

Pasadena area, including an interchange of the Pasadena, Foothill, Colorado and Long Beach Freeways, 3 miles.

Noninterstate routes under study include:

Beverly Hills Freeway (Route 2), from the San Diego Freeway to Ardmore Avenue, near the Hollywood Freeway; public hearing held April 22-23.

Pacific Coast Freeway (Route 1) from Malibu Canyon Road to terminus of Santa Monica Freeway in the City of Santa Monica, 13 miles. The 22.5-mile section of this freeway from Malibu Canyon Road north to Point Mugu is under consideration by the California Highway Commission for route adoption, following a commission hearing on February 25, 1964. Other unadopted portions of this route in Ventura, Los Angeles and Orange Counties are under study.

Simi Valley Freeway (Route 118) from DeSoto Avenue to the proposed Foothill Freeway (public hearing held January 9, 1964); and from the Route 126 Freeway near Saticoy to First Street near Moorpark.

Century Freeway (Route 42) from Pacific Coast Freeway to Santa Ana Freeway, public hearing held June 5, 1963.

Route 126 Freeway from Santa Paula city limit to the Los Angeles county line, public hearings held June 26, 1963, and January 15, 1964.

Oxnard Bypass, public hearings held September 18, 1963, and January 15, 1964.

San Gabriel River Freeway (Route 240) from the Garden Grove Freeway to Pacific Coast Freeway in Seal Beach.

Riders follow the bridle path alongside the Golden State Freeway near Griffith Park, Los Angeles. Trees recently planted inside the freeway fence will add to attractiveness of the area in future years.

Long Beach Freeway (Route 7) from the Foothill Freeway, Route 134 and Long Beach Freeway Interchange to Norwich Avenue.

Portions of three freeway routes were adopted during the year, totaling 22.3 miles and representing an estimated cost of $109 million. Routes adopted were:

—On January 23, a 2.7-mile section of the Glendale Freeway from Ardmore Avenue to Glendale Boulevard, estimated to cost $27.5 million.

—On May 22, a portion of the Pacific Coast Freeway in Orange County, from 0.8 mile south of MacArthur Boulevard to 0.2 mile north of Adams Boulevard, 10.2 miles, estimated to cost $63.4 million.

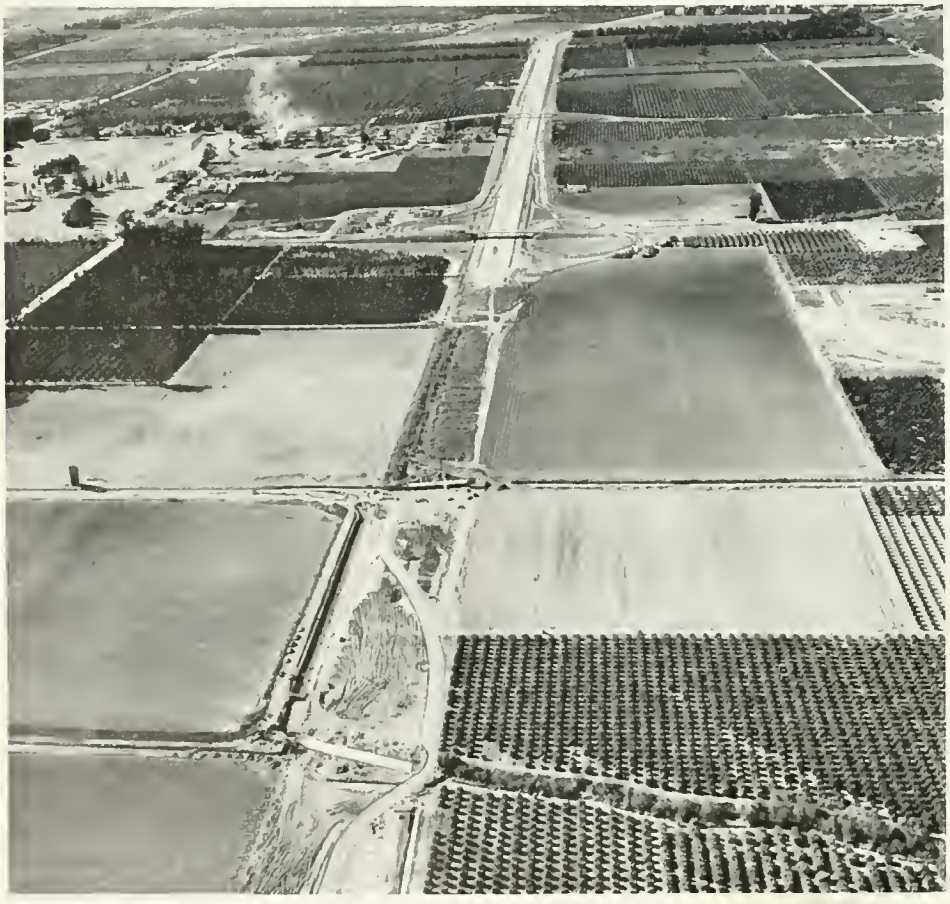
—On June 26, a 9.4-mile section of the Route 126 Freeway between the Golden State and Antelope Valley Freeways, estimated to cost $18 million.

In District VII the Highway Commission has now adopted 832 miles, or 53 percent, of the 1,570 miles of the California freeway and expressway system in the district. It is anticipated that the adopted mileage will be considerably increased in 1964, on the basis of a number of route studies nearing completion. The year got off to a fast start with the holding of three public hearings on freeway routes in the first 15 days.

Construction Progress

There were continued developments in the field of portland cement concrete paving construction during the year. On two projects on the Santa Monica Freeway a turbine-type mixer was used in the concrete batch plant. This unit proved successful in producing a consistent, well-mixed concrete for structure work, and the contractor plans to use it for pavement concrete during 1964.

An interchange between the Golden State Freeway and the future Route 126 Freeway is under construction at Castaic, on the Ridge Route north of San Fernando. The project is part of a program to improve the Golden State (Interstate Route 5) to full freeway standards between San Fernando and the Kern county line.



The Route 126 Freeway is under construction northeastward from Saticoy to Santa Paula through the Santa Clara River valley in Ventura County. This 8.5-mile project, under contract for nearly $7,000,000, will be completed in mid-1965. This view is westward along the completed section toward Ventura.

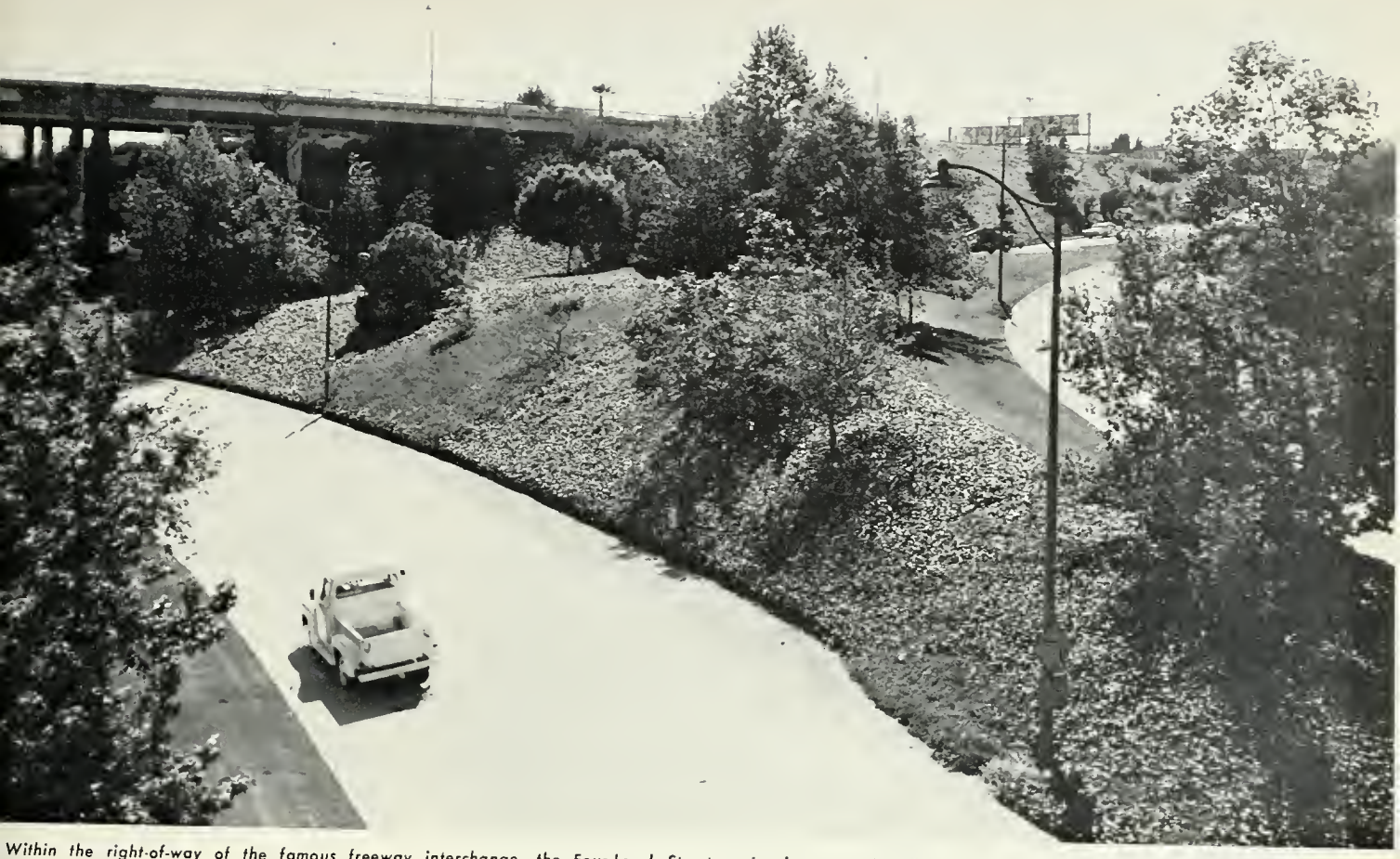
A low-profile batch plant has been installed on a San Diego Freeway contract near Long Beach, consisting of two eight-cubic-yard mixers which will be charged through the use of belts. Production has not yet started, but it was reported that a similar unit was successful in another district.

Also during the year a slip-form paving machine was used for the first time in this district on a freeway *widening* project. The machine is currently being used successfully on a Santa Ana Freeway contract, and the contractor plans to use it on a similar job in the near future.

The construction industry is working to develop equipment capable of placing plastic strips to form the transverse joints in concrete paving and thereby eliminate the need of sawing joints. A similar method of forming the longitudinal joints in multilane paving operations has been successfully used for some time. Transverse joints were placed in this manner on one section of the San Diego Freeway, and the finished product was of fairly good quality. Suppliers are continuing to develop techniques and equipment.

Another experimental project was started to determine the value of expansive-type cement in the portland cement concrete pavement construction and to employ plastic sheeting as a curing agent. This experiment, conducted on the Antelope Valley Freeway, will evaluate the effect, if any, of expansive cement upon the placement, curing and cracking of portland cement concrete pavements. Transverse joints were eliminated in this experiment and the slab was allowed to crack at random. To date no significant effects have become evident.

Experiments in slope stabilization were started during the year, using new types of mulch to control severe erosion due to ocean fogs and winds. One special mulch consisted of processed garbage and refuse; another was a wood pulp derivative. Grass seed was introduced into the stabilizing material and the mulches were sprayed on a test slope. No major problem was encountered in the application of the materials; but conclusive results of the experiment are not yet available.



Within the right-of-way of the famous freeway interchange, the Four-Level Structure in downtown Los Angeles, plantings have created parklike areas to beautify this part of the city.

Maintenance

Maintenance costs in District VII continued to increase as added highway mileage resulted in a greater volume of work. Expenditures in the 1962–63 fiscal year totaled approximately $9,700,000, about 18 percent more than the preceding year.

The district maintained 1,527 centerline miles of roadway, equal to approximately 2,336 miles of comparable two-lane roadway. Included in the total were 559 conventional two-lane miles and 671 miles of four or more lanes, with an additional 448 miles of ramp and collector roads. Other major items covered in the year's operations were 196 miles of guardrail, 130 miles of cable chain link median barrier fence, 30 miles of blocked-out metal beam median barrier, and 2,774 curb miles of sweeping.

District forces also cared for 1,453 acres of landscaping, 4,654 acres of roadside, and nearly 50,000 trees.

Cost of clearing state highway routes of debris continued to increase. In the 1962–63 fiscal year sweeping and trash pickup by state forces cost $749,121, and cities spent $286,606 on city-maintained routes, for a grand total of $1,035,727.

Median Barriers

Installation of median barriers as a safety feature on freeways continued in 1963, and at the yearend there were 145 miles of cable chain link barriers and 30 miles of blocked-out metal beam barriers in District VII.

Repairs to these barriers, resulting from accidents, cost $362,627 during the year. Of this amount, $309,760 was collected or considered collectible from 85 percent of the known motorists responsible for the damage. Expense to the State was $52,867 in cases where responsibility could not be fixed or where damages could not be collected. Cost of repairing the cable chain link fence averaged $2.75 per foot. Median barrier repairs constituted about 90 percent of the loss reports filed in the district each month. A working force of 40 men, 35 of them full time, was required to maintain the barrier fence.

Early in 1964 a five-mile section of cable chain link barrier was being installed on the Ventura Freeway west of Reseda Boulevard in the San Fernando Valley, which will complete the barrier on this freeway almost to the Ventura county line. A special feature of the project is the provision for removal of a 40-foot section of the barrier to permit the crossing of huge rocket boosters being transported in the vicinity. The barrier design was modified to expedite the removal and replacement of the posts for this purpose.

Right of Way

During the year the district invested $64,229,000 in 2,104 parcels of property required for the freeway program, an average price of $30,527 per parcel. Some of the larger right-of-way expenditures were for the following freeways:

Artesia	$10,560,000
Colorado	8,504,000

San Gabriel River	$5,544,000
Foothill	4,274,000
Garden Grove	3,691,000

Property appraisers noted that real estate values have continued to increase until the cost of right-of-way required for freeway projects in the metropolitan area now exceeds construction costs by as much as 50 to 300 percent. There has also been a considerable rise in suburban property values. As a result, right-of-way costs, more than ever before, are controlling factors in freeway route location.

The Right of Way Department appraised 1,496 parcels of property having a total appraised value of $42,500,000.

For the Route Planning and Design Departments, 196 estimates of property values were made, on 87,581 parcels, valued at $3,600,000,000.

Sales of excess lands and buildings resulted in a gross return of more than $5,000,000, most of it from the sale of 452 parcels of property at public auction.

Rental of state-owned property averaged 3,000 active accounts during the year, and resulted in revenue of approximately $3,000,000. The leasing of 31 parking areas located beneath the viaduct section of the Santa Monica Freeway in downtown Los Angeles brought in approximately $15,000 a month, or $180,000 a year.

Landscaping beautifies the space between business buildings and the right-of-way along the Harbor Freeway in downtown Los Angeles. The view is northward toward the Four-Level Interchange.

The program of relocation advisory assistance was actively carried on during the year to help families required to vacate state-owned property. Assistance in finding new homes is offered directly to those affected, and the State also works indirectly by coordinating its efforts with the city agencies concerned.

One phase of the program is to disseminate information to community groups and public agencies by speakers. More than 1,100 information letters were sent, and reports were made to cities, redevelopment agencies and other organizations.

Landscaping

Roadside beautification takes on added significance each year as the freeway network expands. In District VII, 13 contracts were awarded in 1963 for landscaping, functional and tree-planting work, at a cost of $1,300,000. These projects included 33 miles, or 244 acres of plantings.

One example of the year's activity was the landscaping of the recently completed Ventura Freeway in the City of Ventura. This illustrated the purposes of such development: to make the freeways attractive to motorists, to contribute to the esthetic values of the community, to maintain or enhance the values of adjacent properties, and to prevent erosion of slopes. As a result of the project in Ventura, the drive through the city is considered one of the most scenic in Southern California.

Elsewhere in District VII, the landscaping of the Pasadena–Golden State Freeway interchange was completed; work was started in the Santa Monica–Harbor Freeway interchange; planting in the Hollywood–Ventura Freeway interchange area was completed and extended to the temporary end of the Hollywood Freeway at Magnolia Boulevard. Planting was done in the San Diego–Ventura Freeway interchange area, and there was a seven-mile tree planting project on the Newport Freeway between the Santa Ana and Riverside Freeways.

Transportation Study

Along with the planting, design and construction of the California freeway and expressway system, the Division of Highways is coordinating the

Los Angeles Regional Transportation Study. The LARTS project, underway since January 1960, is moving forward with the cooperation of the U.S. Bureau of Public Roads, U.S. Housing and Home Finance Agency, the five counties of Los Angeles, Orange, Ventura, San Bernardino, and Riverside, and 122 cities in these counties.

It was organized along the same lines as other successful state–local studies, with an advisory committee of local officials from public and private agencies. Its purpose is to determine the present and future needs for moving people and goods in the greater Los Angeles area by relating these movements to distribution of land uses, population, employment, and other factors affecting travel. The study has been established as a continuous planning operation utilizing new data and methods in an orderly program of updating.

Steps are now being taken to insure LARTS' compliance with the 1962 Federal Highway Act. To qualify for federal highway funds, each urban area of over 50,000 population must have a continuous comprehensive transportation planning process in operation by July 1965. There are 11 such areas in California, three of them in the LARTS study area.

The first major phase of the study, *LARTS Base Year 1960 Report*, has been completed. An article summarizing these results appears in this issue of *California Highways and Public Works.*

The report contains four chapters and a separately bound appendix. The first chapter, an introduction and summary, includes a brief statement of the problem, the purpose, the study strategy, the results, and the success of the study thus far. The second is a discussion of the organization and financing of the study. The third gives the present and historical background of the LARTS study area, including topography, climate, transportation, and a review of its people and economy from 1770 to 1960. Chapter four describes the methods, reliability, availability, and use of results. The appendix is primarily a technical discussion of methods and results, with

Completion of the Ventura Freeway through the City of Ventura last June relieved traffic congestion on city streets and gave motorists a scenic drive along the shore. This view is southeast along the new freeway, with the Ojai Freeway curving off to the left.

This scenic spot on the Ventura Expressway (Route 101) at the Ventura–Santa Barbara county line, is planned for conversion to full freeway. The planting in the median complements the natural growth in this seaside area.

District VII's first freeway opening of 1964 was a 1.8-mile segment of the San Diego Freeway between the Long Beach Freeway and Atlantic Avenue in Long Beach, on January 15. From Atlantic Avenue (center of photo) the freeway is under construction to the Orange county line, a distance of 5.4 miles, with completion expected in the latter part of this year. Further construction is in progress across Orange County as far as Beach Boulevard in Westminster.

emphasis on the adjustments and modifications required.

The results contained in this report serve to illustrate the methods, demonstrate the relationships between land use and transportation which provide the basis for projecting future traffic, and exemplify the types and extent of detailed information available to the study participants. The next report, due later this year, will contain projections to 1980 of population, employment and land use, and an analysis of the resulting travel patterns.

Current Outlook

District VII is working to provide a highway transportation system for Los Angeles, Orange and Ventura Counties to serve a population which is now 7,895,000 and which seems likely to double by 1980. More than 4,400,000 motor vehicles of all types are now in operation, and there will be twice as many in 1980.

While these increases are taking place, the California freeway and express system in the district will be expanded from the present 430 miles, built at a cost of $1,400,000,000, to 1,570 miles, representing an investment of $5,200,000,000.

Late in January, 1964, going contracts in the district totaled $148,000,000, of which about $132,000,000 was for construction of 58 miles of freeways. It is estimated that about 22 miles of the system will be completed in 1964, of which more than 17 miles will be on interstate routes. The drop in completed mileage from one year to the next does not indicate a smaller program, but merely means that project completion dates may or may not fall within a given year.

The annual highway improvement program, as indicated by the 1964–65 fiscal year budget, is $173,000,000, of which $100,000,000 is for construction and $73,000,000 for acquiring right-of-way. The size of the program is expected to increase in coming years as it progresses toward completion of the interstate system routes by 1972, and completion of the entire California freeway and expressway system by 1980.

INTERSTATE FREEWAYS

San Gabriel River Freeway (Interstate 605)

Construction work is being pushed on this north-south route which will connect two other interstate routes, the San Bernardino and San Diego Freeways, in southeastern Los Angeles County and a corner of Orange County. Construction is underway for 12 miles from the San Bernardino Freeway in El Monte south to 166th Street in Dairy Valley. There are four going contracts, amounting to more than $24,000,000, with completion dates falling between mid-1964 and late 1965. One project includes an interchange with the Santa Ana Freeway.

Three more projects, totaling nearly $23,000,000, will be started later this year, extending construction for another nine miles to the Orange county line, and including an interchange with with the future Artesia Freeway. Within this nine-mile stretch, one first-stage contract, for an overcrossing and approaches at 195th Street and Centralia Road, is due to be finished in May 1964.

The northerly extension of the San Gabriel River Freeway, 5.4 miles in length, between the San Bernardino Freeway and the future Foothill Freeway, is being designed and right-of-way is being acquired. This section, not on the interstate system, is now designated as Route 243. Construction is about four years in the future.

Similarly, the southern extension, from the San Diego Freeway to the Pacific Coast Highway, is noninterstate. It is now designated as route 240. Studies leading to adoption of the route are in a preliminary stage.

When completed, the San Gabriel River Freeway will represent an investment of more than $128,000,000 for construction and rights-of-way.

Foothill Freeway (Interstate 210)

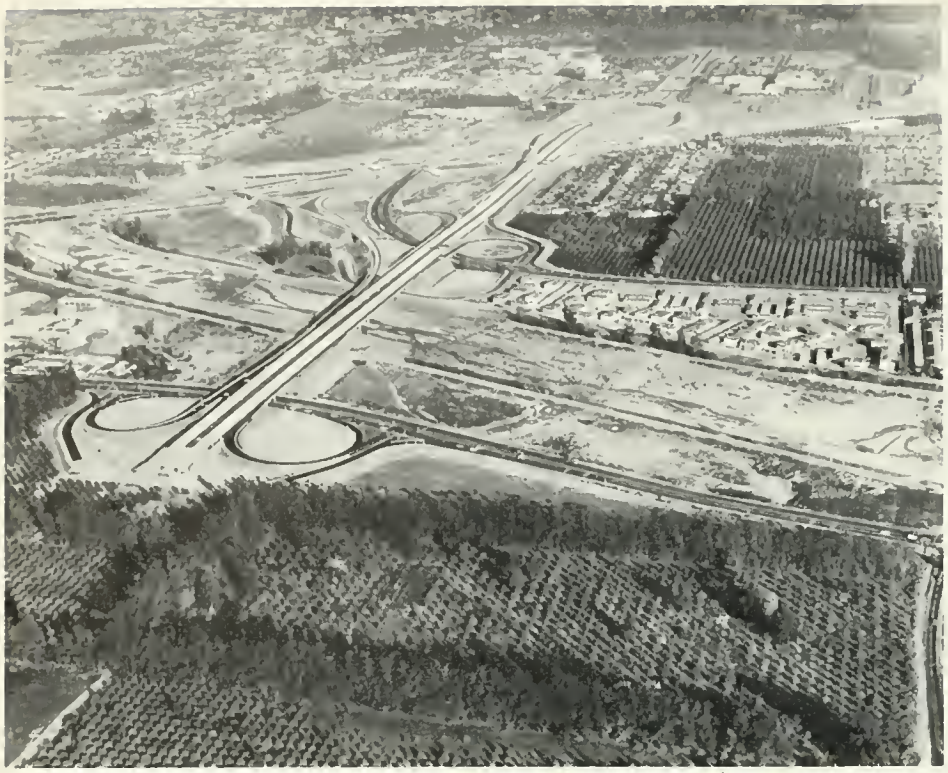
Public hearings will be held by mid-1964 on two segments of this route in the expectation of completing adoption of the entire 53 miles within Los Angeles County this year. The portions under study are a 10.5-mile section in the Sunland-Tujunga, Montrose and La Canada communities between Foothill Place and Hampton Road, and a short piece in Pasadena which will be part of an interchange of the Pasadena, Foothill, Colorado and Long Beach Freeways.

A two-mile section north of Pasadena between Hampton Road and Montana Street is constructed, and the route has been adopted from the Golden State Freeway east to Foothill Place near Hansen Dam, and from Michillinda Avenue in Arcadia to the San Bernardino Freeway near the county line. These adopted sections, totaling about 40 miles, are being designed. Ultimate cost of the route will exceed $243,000,000.

A freeway agreement has been signed with the City of Pasadena for the route between Marengo Avenue and the east city boundary near Eaton Wash. A freeway agreement also has been completed with the City of Arcadia for the section between Michillinda Avenue and Fifth Avenue. Acquisition of right-of-way has started in Pasadena, and is well along in the Arcadia area. Construction in this area is expected to start in about five years.

The main line of the Atchison, Topeka and Santa Fe Railroad is to be depressed alongside the freeway between Marengo Avenue and Wilson Avenue, and throughout the section between Eaton Wash and Santa Anita Avenue in Arcadia the railroad will be relocated in the median area of the freeway. This will not be a longitudinal encroachment as the railroad right-of-way will be excluded from the free-

Motorists crossing the Vincent Thomas bridge spanning Los Angeles Harbor have this view of San Pedro as they pass the tall plaza on Terminal Island. This $21,000,000 structure was dedicated September 28, 1963, and opened to traffic November 15.



The heart of the freeway network in Orange County, the Santa Ana–Garden Grove–Orange Freeway Interchange, will be completed in the latter port of this year. Looking east, the Santa Ana and Garden Grove seporation is at top right of photo. The completed section of the Garden Grove Freeway (left center) will be extended westward across Orange County. The Orange Freeway will be constructed in this area later.

This 1.5-mile section of the Garden Grove Freeway in Orange County between Garden Grove Boulevard near Knott Avenue and Newland Street will be completed late in June this year. It now appears to be isolated, but work will soon be in progress to connect this section with the rest of the route. View is eastward. Garden Grove Boulevard at left.

way right-of-way. The tracks will be depressed between Marengo and Wilson Avenues to avoid railroad grade crossings immediately adjacent to ramp connections to city streets. Relocation of the railroad to the median area is to facilitate design of the Rosemead Boulevard interchange. Steps are being taken to move the old Santa Anita railroad station, once used by Lucky Baldwin, to the State and County Arboretum property.

Santa Monica Freeway (Interstate 10)

All of the uncompleted part of this freeway, about 12 miles between Vermont Avenue in Los Angeles and the western terminus in the City of Santa Monica, is under construction. Work began early this year on the last contract, covering 3.6 miles between Sawtelle Boulevard in West Los Angeles and the Pacific Coast Highway. The four contracts now under way amount to more than $33,000,000.

The freeway is completed for 4.3 miles eastward from Vermont Avenue to the East Los Angeles Interchange, including an interchange with the Harbor Freeway.

The most extensive construction project now in progress is the interchange with the San Diego Freeway in West Los Angeles, which will be completed early in 1965. It may be possible, however, to open the freeway to traffic from Vermont Avenue west to La Cienega Boulevard in the latter part of this year. Completion of the entire 17-mile route between Los Angeles and Santa Monica, at a cost of about $202,000,000, is expected late in 1965 or early in 1966.

San Diego Freeway (Interstate 405)

This important Interstate route extends for 93.6 miles in District VII from the Golden State Freeway north of San Fernando to the San Diego county line at San Clemente. It is completed for about 43 miles from its northern terminus to Atlantic Avenue, east of the Long Beach Freeway, and is under construction southeastward to Beach Boulevard in Westminster.

Construction will start soon on a first-stage embankment contract for portions of the route between Beach Boulevard and Harbor Boulevard in Costa Mesa. Construction on the 17.5-mile stretch from Beach Boulevard to

the Santa Ana Freeway will be accomplished in four projects, expected to start progressively during the next four fiscal years.

The freeway is completed southward from its junction with the Santa Ana Freeway near Irvine to the county line. This 22-mile stretch will be widened to eight lanes, starting in the next two or three years. When completed, this freeway will represent an investment of approximately $372,000,000.

Santa Ana Freeway (Interstate 5)

Continuing a program that has been in progress for several years, this freeway is being widened for a distance of about 10 miles, between Main Street in Santa Ana and Laguna Canyon Road. This work, being done in two contracts, will be completed in the late spring of this year. The widening will be continued in coming years to the junction of the San Diego Freeway near Irvine.

Work on the Santa Ana–Garden Grove–Orange Freeway interchange, heart of the freeway network in Orange County, is scheduled to be finished in September at a cost of almost $11,000,000. The principal contract covers 1.5 miles on the Santa Ana Freeway between the Santa Ana River and Main Street, and about one mile on the Garden Grove Freeway from Bristol Street to Main Street. This $7,201,100 job started in August 1962. The interchange complex includes 16 bridge structures. There is a separation for the Santa Ana and Orange Freeways, another for the Santa Ana and Garden Grove Freeways, and a third at Main Street and the Garden Grove Freeway. The Orange Freeway is expected to be constructed in this area by 1970.

Another contract in the interchange area, including 0.8 mile of the Garden Grove Freeway, four bridges and widening of the existing Santa Ana River bridge, was completed in mid-1963 at a contract cost of $3,620,000.

Golden State Freeway (Interstate 5)

This Interstate route was completed through the San Fernando Valley when the 6.2-mile link from Osborne Street in Pacoima to the junction with the San Diego Freeway north of San Fernando was opened to traffic last November 8. The route is now in operation as a freeway for 27.7 miles from the East Los Angeles Interchange to the San Diego Freeway, and continues as an expressway north to the Kern county line. Total distance in this district is 73 miles.

The Yorba Linda Freeway, opened in February 1963, serves a rural area in northern Orange County where new homes are being built among citrus orchards and small farms. This 2.3-mile section of freeway extends from Orangethorpe Avenue, lower left, to the Yorba Linda community, top center. Orangethorpe is only one mile from the east-west Riverside Freeway.

Conversion of the expressway mileage to full freeway standards is in progress. Work started last June on a $5,646,609 project covering 3.7 miles in the Castaic area. The job also includes 0.8 mile of the Route 126 Freeway and an interchange, to be finished in early 1965. This project is the first of 14 planned to convert the Golden State to an eight-lane freeway.

A contract for widening a 1.3-mile segment of the freeway in Burbank and Glendale from six lanes to eight lanes started early this year.

San Bernardino Freeway (Interstate 10)

This major east-west route extends from the Golden State Freeway near the East Los Angeles Interchange across Los Angeles County to the San Bernardino county line. The mileage in this district is 30 miles, on which more than $63,000,000 has been expended.

The route, which has been in service for a number of years, has been widened for a considerable distance as traffic increased, and other such projects are planned. The 1964–65 fiscal year budget includes $660,000 for reconstruction of part of the Vincent Avenue interchange in West Covina.

NON-INTERSTATE FREEWAYS

Antelope Valley Freeway (Route 14)

The first section of this freeway, which will bring the high desert country of northern Los Angeles County closer to the metropolitan area, was opened to traffic last October. This 14.4-mile segment, between Solemint and Red Rover Mine Road, was completed in two contracts totaling $14,786,000.

Work is in progress on another 7.9 miles which will extend the freeway northward to a junction with the Angeles Forest Highway near Vincent. This $4,978,887 contract also includes widening the existing Sierra Highway to four lanes for about 0.7 mile between the Angeles Forest Highway and the Pearblossom Highway. This job is due for completion

These massive columns will support a structure at the interchange between the Santa Ana and San Gabriel River Freeways, now under construction in the Santa Fe Springs area.

in the spring of 1965. The next step, for which $5,100,000 is budgeted, will be to construct the freeway to Avenue P-8 in Palmdale.

(For details on this freeway see article in *California Highways and Public Works*, January-February, 1964.)

Artesia-Riverside Freeway (Route 91)

The westerly portion of this route, sometimes called the Artesia Freeway, extends 21.6 miles between the Santa Ana and San Diego Freeways. It is constructed as a four-lane and six-lane expressway for 4.8 miles between Normandie Avenue and Alameda Street. This is to be converted to a freeway in six or seven years. From Normandie Avenue to the San Diego Freeway the route has not been adopted.

From Alameda Street east to the Santa Ana Freeway the freeway is being designed in five sections, and construction is expected to start in the 1965–66 fiscal year and be completed by 1970. It is planned as a six-lane and eight-lane facility.

The Riverside Freeway extends 19 miles from the Santa Ana Freeway to the Riverside county line, and beyond, in another district, to the City of Riverside. From the Santa Ana Freeway to Harbor Boulevard, a distance of 5.7 miles, the route is full freeway; the remaining mileage in this district is expressway, which will be converted to freeway.

By the middle of this year a $1,400,000 project will be started to construct an interchange at Dowling Avenue in Anaheim. At this location the four-lane expressway will be converted to six-lane freeway.

Early in 1965 it is proposed to widen the expressway to six lanes between Lemon Street and Placentia, and to convert to six lane freeway from Placentia to Newport Freeway, all included in a $5,100,000 project covering 5.8 miles. Some time after 1970 the full freeway will be extended all the way to Riverside County.

Route 134 Freeway

This route has been known unofficially as the Colorado Freeway.

Design of the portion which will form an eastward extension of the Ventura Freeway from the Golden State Freeway through Eagle Rock to the future Foothill Freeway in Pasadena, is well underway.

First work, expected to start late this year, will be construction of a bridge at Jackson Street in Glendale, preparatory to extending Monterey Road a short distance westward. A project including an interchange with the Golden State Freeway and bridges across the Los Angeles River for a connection to San Fernando Road is expected to be budgeted the following year. The next project probably will extend the freeway east of San Fernando Road to the vicinity of Glendale Avenue. Most of the right-of-way for these three projects has been acquired.

In the Glendale area this freeway will interchange with the north-south Glendale Freeway. The section between the Glendale Freeway and Avenue 64 is generally on a side hill overlooking the Eagle Rock district. Design is proceeding on the basis of split-level roadways and the use of bin-type retaining walls to avoid unsightly cuts.

The section between Avenue 64 and Orange Grove Avenue, built some years ago as a four-lane facility, will be reconstructed to eight lanes. Consideration also will be given to widening the existing Pioneer Bridge over the Arroyo Seco in Pasadena without interfering with the old Colorado Street Bridge.

(A report on the effect of this proposed freeway on land values and real estate activity in Glendale appears elsewhere in this issue.)

Garden Grove Freeway (Route 22)

This freeway is being built as an east-west route to connect the Pacific Coast Highway in Los Angeles County with the Santa Ana and Newport Freeways in Orange County, a distance of about 15 miles. A short section of about 0.8 mile in the vicinity of the Santa Ana Freeway was completed last August.

Construction is underway for 1.5 miles between Garden Grove Boulevard near Knott Avenue and Newland Street, to be completed in mid-1964 at a cost of $3,744,806. Work will start early this year on a one-mile section from Haster Street to Manchester Avenue, and by the middle of the year it is expected that three more contracts will be in progress, covering a distance of 4.7 miles from Haster Street to Newland Street.

It is anticipated that funds to complete the freeway to its eastern terminus at the Newport Freeway will be provided in the 1965–66 budget. Construction of the westernmost two miles between the Pacific Coast Highway and the San Diego Freeway probably will start after 1970.

Glendale Freeway (Route 2)

The Glendale Freeway, a part of the new Route 2, will extend for a distance of 12.2 miles from the Hollywood Freeway through the Silver Lake District of Los Angeles and through the City of Glendale to a connection with the proposed Foothill Freeway (Interstate 210).

The existing six-lane 2.4-mile section between the Los Angeles River and Avenue 36 will be widened to eight lanes at an estimated cost of $1,500,000.

Design work is in progress on two portions of the route totaling 9.1 miles. The section from the Hollywood Freeway to Glendale Boulevard will include an interchange with the Hollywood Freeway near Vermont Avenue. The other section extends from Avenue 36 to Foothill Boulevard.

Looking south along the San Gabriel River Freeway under construction. Rose Hills Road crossing is in center, and Whittier Narrows Dam is at the left.

Interchange begins to take shape at Valley Boulevard as the San Gabriel River Freeway construction is being pushed in southeastern Los Angeles County.

Freeway agreements have been executed with the City of Glendale for a portion of an interchange between the Glendale and Colorado Freeways. Other necessary agreements are expected to be executed by mid-1964.

Harbor Freeway (Route 11)

This freeway, which connects downtown Los Angeles with the harbor district, was completed in 1962 from the Four-Level Structure to San Pedro, a distance of 22 miles, at a cost of $104,600,000.

Design of a project to widen a four-lane section between Battery Street and Pacific Coast Highway to six lanes is nearing completion.

An interchange between this freeway and the Long Beach Freeway to the west of the recently completed Vincent Thomas Bridge is being designed.

Hollywood Freeway (Route 101-170)

The Hollywood Freeway, completed from Spring Street in downtown Los Angeles to Magnolia Boulevard in North Hollywood, will be under construction in 1964 toward its junction with the Golden State Freeway in Pacoima. First work to start will be construction of embankment from Laurel Canyon Boulevard to the northern terminus, a cooperative project in which the Los Angeles City Department of Water and Power will supply 1,250,000 cubic yards of earth from its Tujunga Spreading Grounds.

The next step, to be started later in the year, will be the construction of the 2.5-mile freeway section between Magnolia Boulevard and Victory Boulevard. A later contract will cover the construction from Victory Boulevard to the Golden State Freeway.

Preparations are being made to widen the Hollywood Freeway from six lanes to eight lanes in the Hollywood area, from Sunset Boulevard to the Pilgrimage Bridge. The first project will be to add one outbound lane in the two-mile section from Franklin Avenue to the Pilgrimage Bridge, for which $800,000 is budgeted.

Huntington Beach Freeway (Route 39)

Route location studies were started in 1958 on this north-south route which is planned to connect the Pacific Coast Highway and the Foothill Freeway in the general vicinity of the existing Beach Boulevard. A public hearing is expected to be held in the latter part of 1964 on the portion of the route between the Pacific Coast Highway and the Garden Grove Freeway. Studies on the northern part of the route will be presented at a later public hearing.

Long Beach Freeway (Route 7)

The Long Beach Freeway, in operation for several years between the City of Long Beach and the San Bernardino Freeway, will be extended north to the Foothill Freeway in Pasadena, and southwest to the Harbor Freeway in San Pedro. The section between Long Beach and San Pedro, including the completed Terminal Island Bridge, formerly was referred to as the Seaside Freeway.

Construction started late in 1963 on a one-mile extension of the freeway north from the San Bernardino Freeway to Valley Boulevard. The route has been adopted for another 1.1 miles to Huntington Drive, and is under study north to Foothill Boulevard. This latter section, on which a public hearing will be held this spring, will include an interchange of the Long Beach, Pasadena, Colorado and Foothill Freeways in the Pasadena area. Construction of this interchange will be a major step in linking the freeways of the district into a smoothly operating system, and will provide many new alternate routes of travel.

Meanwhile there are plans to start next year on the job of widening the freeway from six to eight lanes for a distance of 13.4 miles between the Santa Ana and San Diego Freeways, at an estimated cost of $4,500,000.

Marina-Slauson Freeway (Route 90)

The new Route 90 Freeway will combine the old Marina Freeway which was a part of former Route 60, and the Slauson Freeway, former Route 221. Route 90 is planned to extend for a distance of 22.2 miles between the Pacific Coast Freeway, and the San Gabriel River Freeway. The westernmost 2.6 miles, between Lincoln Boulevard and the San Diego Freeway, has been adopted, design work is in progress, and right-of-way has been acquired. Funds are budgeted for construction of part of an interchange with the San Diego Freeway. The exact western terminus of the route depends on the location ultimately selected for the Pacific Coast Freeway in the area.

Location studies are in progress on the eastern part of the route between the San Diego and San Gabriel River Freeways.

Newport Freeway (Route 55)

This north-south route in Orange County is completed from the Riverside Freeway to the Santa Ana Freeway, a distance of 6.6 miles, and is under construction south for another two miles to Warner Avenue. This section is due for completion late in 1964, and construction is expected to start early in 1965 on a 3.9-mile project from Warner Avenue to Bristol Street–Palisades Road. When completed, this freeway will be 17.7 miles in length, extending southward to the Pacific Coast Freeway, and carrying traffic on four lanes, with provision for widening to six lanes.

Ojai Freeway (Route 33)

This freeway is completed for four miles north of Ventura to Mills School. An interchange with the Ventura Freeway was opened in June 1963. The route is adopted for 11 miles from Mills School to Cozy Dell Canyon, northwest of Ojai, and this section is being designed. Location of the remainder of the route in this district, extending to the Santa Barbara county line, has not been adopted.

Orange Freeway (Route 57)

This proposed north-south route will be important to eastern Los Angeles and Orange counties. It will extend south from the Pomona Freeway crossing the proposed Yorba Linda Freeway and the existing Riverside Freeway, passing through the Santa Ana–Garden Grove interchange, and continuing south to the Pacific Coast Highway. The route has been adopted for a distance of about 20 miles between the Pomona and Santa Ana Freeways. The route between the Santa Ana and Pomona Freeways is being designed in six sections, with construction several years in the future.

Division of Highways snow removal equipment keeps mountain roads open during the winter months as thousands of snow sports enthusiasts drive to recreation areas in Los Angeles County. One of the popular routes is the Angeles Crest Highway, pictured here as it was last December.

Pacific Coast Freeway (Route 1)

This is the longest freeway planned in District VII: it will extend about 113 miles from the Ventura Freeway north of Oxnard to Serra Junction at Capistrano Beach, in Orange County. The only portions constructed to date are a 6.8-mile section south of Oxnard and a connection between the Pacific Coast Highway and the San Diego Freeway in Capistrano Beach. Adopted portions of the route total 31 miles.

Briefly, the status of the route, from north to south in the district, is as follows:

El Rio to Oxnard: location of the route is being considered in connection with the Oxnard Bypass, on which two public hearings have been held.

Oxnard to Calleguas Creek, 6.8 miles constructed in 1957.

Conversion of the existing three-lane Pacific Coast Highway to freeway standards in the vicinity of Point Mugu Naval Station is planned for the future.

Calleguas Creek to Malibu Canyon Road: California Highway Commission hearing on adoption of route, about 22 miles, was held in Santa Monica February 25, 1964, and two district hearings were held in 1961.

Malibu Canyon Road to terminus of the Santa Monica Freeway in the City of Santa Monica: In addition to conventional inland locations, route location studies on this 13-mile section are considering the possibility of locating all or part of the freeway on a causeway offshore in the ocean; an alignment along the existing shoreline on a widened beach; or various combinations of causeway and shoreline locations.

In 1961 the U.S. Army Corps of Engineers was engaged by the Division of Highways to study the feasibility of the marine locations. A report of this study, received in November 1963, is being reviewed by the division and by other interested state agencies. This report covers only the marine phase of the project. Conventional land locations are being studied by the division.

The Corps of Engineers investigated nine alternate offshore and onshore freeway alignments involving earth fills and embankments, beach widening and structures. Initial costs were estimated at from $121,000,000 to $408,000,000. The report concluded that:

1. It is engineeringly feasible to construct the proposed freeway on a marine alignment.

2. A joint highway-recreational facility extending from Santa Monica to Malibu would enhance the recreational potential of the area.

3. Maintenance and sand bypassing operations in connection with each of the plans considered are feasible.

4. It is not expected that building any of the considered projects would pose insurmountable problems to the construction industry.

From Santa Monica south to the end of the route, location studies are being made except in the following areas: 10 miles in Orange County (Huntington Beach–Newport Beach) already adopted; 14 miles between El Segundo and the Harbor Freeway in Wilmington; and about 3 miles between the Marina del Rey and Olym-

pic Boulevard on the Santa Monica Freeway.

The Division of Highways is carrying on a program of improvements to existing Pacific Coast Highway facilities in Orange County to provide better traffic facilities in the interim before the freeway is built. The general objective is to provide a four-lane divided highway with median wide enough for left-turn pocket lanes, wider shoulders, improvements to the signal system. Some of these projects are financed in part by the cities concerned.

Pomona Freeway (Route 60)

Construction started late in 1963 on the Pomona Freeway, an eight-lane east-west facility that will link Los Angeles and Pomona by 1970. As U.S. 60 it will extend eastward beyond District VII to Riverside to connect with routes going north, south and east. At the Los Angeles end it ties into the Santa Monica, Santa Ana and Golden State Freeways. Ultimate cost of the 30-mile freeway is estimated at $93,000,000.

The first segment, to be completed in about two years at a cost of more than $8,000,000, will take the freeway 2.2 miles east from the East Los Angeles Interchange to Third Street near Downey Avenue. Excess embankment material from this project is being placed along the route between Findlay and Markland Avenues in the Montebello–Monterey Park areas.

Another project started recently will extend freeway construction to Woods Avenue, including a four-level interchange with the Long Beach Freeway. Widening of the Long Beach Freeway between Third Street and Olympic Boulevard also is part of this $10,000,000 project.

The Pomona Freeway is budgeted for the four-mile section from Arroyo Drive in the South San Gabriel area to the San Gabriel River Freeway, and is expected to be opened to that point late in 1966. Substantial traffic relief to the San Bernardino Freeway and parts of the Santa Ana Freeway is anticipated.

Embankment work is in progress in the vicinity of the Atlantic Boulevard interchange, using excess material from the Long Beach Freeway construction project.

Design work is progressing for the easterly portion of the Pomona Freeway through Puente Hills, Hacienda Heights, Puente and Diamond Bar Ranch to the San Bernardino county line near Riverside Drive. The easterly portion of the route will include interchanges with the future Huntington Beach, Orange and Corona Freeways.

Route 126 Freeway

This 51-mile freeway is planned to connect the Ventura Freeway at Ventura and the Antelope Valley Freeway near Solemint, via the Santa Clara River Valley. The first five-mile section, from Ventura to Saticoy, was opened to traffic in April 1963, and another 8.5 miles extending northeastward through the City of Santa Paula is under construction and will be completed in mid-1965.

A public hearing was held in Fillmore January 15 on the location of 22 miles of this freeway between Santa Paula and the Los Angeles county line. From there to the Antelope Valley Freeway the route has been adopted. An interchange with the Golden State (Interstate 5) Freeway is under construction in the Castaic area as part of a freeway conversion project.

Simi Valley Freeway (Route 118)

First construction on this east-west route, to serve the rapidly growing Simi Valley, is planned for the 1965–66 fiscal year. A five-mile section between Kuehner Drive in the eastern end of the valley and Santa Susana Avenue in the west San Fernando Valley, including the Santa Susana Pass, will be the first project started. An estimated $12,000,000 will be required to finance the work.

The adjoining three-mile segment between Kuehner Drive and Tapo Street is tentatively scheduled for construction starting in the 1966–67 fiscal year. The two projects are timed for completion at the same time, thus providing traffic service to the community of Santa Susana at the earliest possible date. Completion of the route five miles fartl. west to Madera Road is anticipated by 1970, at which time the entire Simi Valley will be served by this freeway.

Location of the route between De Soto Avenue and the route of the future Foothill Freeway in the vicinity of Hansen Dam, about 11 miles, was the subject of a public hearing January 9. A hearing is planned early this year on location of the westernmost part of the route, from Madera Road to the Route 126 Freeway near Saticoy, about 16 or 17 miles.

It is estimated that total outlay for construction and right-of-way on this 47-mile freeway will amount to approximately $132,000,000 by 1980.

Pending construction of the freeway, a number of intersections on Los Angeles Avenue, the existing facility, are being improved to help relieve traffic congestion in the valley. First of these projects was completed last May at Tapo Street in Santa Susana, where the intersection was widened to four lanes, left turn lanes provided, and traffic signals installed. A similar improvement, with signals, is planned for Sycamore Drive. Improvements without signals will be made at five other intersections.

Ventura Freeway (Route 101)

The most important event of the year on this freeway was the opening of a 2.7-mile section which completed the route through the City of Ventura. This project, and an adjoining section opened a year earlier, eliminated a traffic bottleneck of long standing by taking through traffic off several miles of city streets. Traffic on Thompson Boulevard decreased 50 percent after the freeway opened.

The latest construction included an interchange with the Ojai Freeway and a short section of that route to connect with previously completed mileage.

North of Ventura a 10-mile section of four-lane highway and expressway extending to the Santa Barbara county line is under design as freeway.

Progress continued during the year in converting expressway portions of this route to freeway. Within the next few years the entire 75 miles from Glendale to Ventura will be freeway. The most recently completed project was the Chesebro Road interchange, costing $530,000.

Seven projects for the construction of interchanges, overcrossings, front-

age roads and other elements required for conversion of the expressway are underway or planned to start in the first half of this year. Several others are in the design stage.

The last large freeway conversion project, extending for 3.6 miles between Vineyard Avenue in El Rio and the completed freeway section near Telephone Road in Montalvo, is financed and will start early in 1965. The work, to cost approximately $7,500,000 will require two years to complete. It will include three interchanges, an overhead crossing of railroad tracks, an additional bridge across the Santa Clara River, paralleling the existing structure, and five other bridges.

Yorba Linda Freeway (Route 42)

The first part of this freeway, 2.3 miles between Orangethorpe Avenue and Yorba Linda Boulevard, was completed in February 1963. One mile of expressway connects the south end of the section to the Riverside Freeway. Ultimately the Yorba Linda Freeway will extend northwestward across Orange County, then west across the proposed Huntington Beach Freeway to a junction with the Santa Ana Freeway in the Norwalk area, a distance of about 20 miles.

Robert M. Haynie Appointed to CTBA

Governor Edmund G. Brown appointed Robert M. Haynie, 49, San Francisco building contractor, to the California Toll Bridge Authority on March 16, 1964.

He succeeds James F. Thacher, who resigned to accept appointment to the Trustees of the California State Colleges.

Haynie, a native of Virginia, attended Randolph–Macon Military Academy there. He was graduated from Tulane University in New Orleans with an LL.B. degree and was admitted to the Louisiana State Bar.

He is a partner in the corporation of Haas and Haynie in San Francisco.

He is a former member of the board of directors of the San Francisco Chamber of Commerce, is a director of Columbia Park Boys Club, and a member of the board of governors of Bay Area Council.

San Diego Will Host June WASHO Meeting

Highway leaders from Texas to Alaska and Hawaii will gather in San Diego in mid-June for the 43d annual conference of the Western Association of State Highway Officials.

The conference, which will take place at the El Cortez Hotel from June 15 through June 18, will bring together highway commissioners, administrators, staff engineers, legal and right-of-way experts from the 14 states whose highway departments and federal bureaus comprise the association, along with automobile club leaders and representatives of the highway construction industry.

The western states' progress in constructing their share of the national system of interstate highways is expected to be a major topic of discussion, along with the outlook for highway improvement after 1972, when the current federal aid program is scheduled to reach completion.

Association President Forrest Cooper, State Highway Engineer of Oregon, will convene the opening session at 2 p.m. on Monday the 15th.

Among the principal speakers scheduled to appear at the general sessions are:

U.S. Undersecretary of Commerce Clarence D. Martin, Jr.; Federal Highway Administrator Rex M. Whitton; Executive Director D. Grant Mickle of the Highway Research Board; California State Senator Randolph Collier; J. Burch McMorran, Superintendent, New York State Department of Public Works, and President of the American Association of State Highway Officials; and Executive Secretary A. E. Johnson of AASHO.

Following the general sessions Monday afternoon and Tuesday morning there will be a series of committee sessions through Thursday morning. Committee activity will be in the fields of construction, maintenance, design, administration, forest roads and legal and right-of-way.

Principal WASHO officers in addition to Cooper are: vice president, John C. Myatt, Chief Engineer, Hawaii Division of Highways; and secretary-treasurer, C. Taylor Burton, Director of Highways, Utah State Department of Highways.

J. C. Womack, California State Highway Engineer and a past president of WASHO, is chairman of the host state committee arranging the conference. California last hosted the WASHO Conference in 1951, in San Francisco.

Kofman Renamed to Highway Commission

Governor Edmund G. Brown has reappointed Abraham Kofman, publisher of Alameda *Times-Star* and San Leandro *Morning News* to the California Highway Commission for a four-year term.

ABRAHAM KOFMAN

Kofman was first appointed by Governor Brown in 1961. A native of Brockton, Massachusetts, he has been in the newspaper business since he was 16. He is a member and former director of the California Newspaper Publishers Association and belongs to the Masons, the Shrine, Elks and Eagles. He is past president of the Jewish Welfare Federation of Alameda and Contra Costa Counties and of the Oakland Lodge of B'nai B'rith.

He acquired the Alameda *Times-Star* in 1939 and founded the San Leandro *Morning News* in 1950.

He and his wife, Sara, have three sons. The family home is at 1940 Franciscan Way, Alameda.

Chairman Alfred J. Stern of the State Park Commission addresses the joint commissions and the audience; at his right is Robert B. Bradford, Administrator of the State Highway Transportation Agency. At Mr. Stern's left is Charles DeTurk, Director of Parks and Recreation, and beside him is John Elsboch of the Park Commission. In the upper row, left to right, is Roger S. Woolley, Highway Commission; Margaret Owings, Park Commission; John Erreca, Director of Public Works; Sterling Cromer, Park Commission, and Karl Wray, Vice Chairman, Park Commission.

Staff members followed meeting intently. Shown here, foreground to background, are J. C. Womack, State Highway Engineer; John A. Legorra, Deputy State Highway Engineer; James Worren, Deputy Chief, Parks; Edward F. Dolder, Director of the Division of Beaches and Parks; Earl Hanson, Deputy Chief, Parks; Carl Anderson, park ranger V, Eureka.

JOINT MEETING

The California Highway Commission and the California State Park Commission met in joint session on January 24, 1964, for the purpose of discussing problems of highway location in and near California state parks. Many members of the staffs of both divisions also attended, as did an audience of about 100 interested citizens.

Below: Another view of joint commissions at meeting. Mr. Womack of Highways in foreground, and at extreme right, (not visible above) is Franklin Payne, Highway Commissioner.

Below: Audience included Joseph Pollard of Los Angeles County; Newton B. Drury, ex-Chief of the Division of Beaches and Parks; Charles L. Howard of Oakland; and State Senator John C. Begovich of Jackson.

In his opening speech, Park Commission Chairman Alfred J. Stern, who presided, said the Park Commission in the past year had adopted a policy resolution which in part says: "Land acquired for the use and enjoyment of the people is preserved for this and future generations as state parks, scenic and scientific reserves, historic units, receration areas and state beaches. These lands shall be fimly held against the pressures of expediency, that is, for use for highways, school sites, parking lots, public buildings, utilities, or other nonconforming uses. . . ."

On behalf of the Highway Commission, of which he is chairman, Transportation Agency Administrator Robert B. Bradford said: "We have the objective of locating routes and spending highway money in the greatest public interest as we see it . . . We never adopt a route . . . without talking to the public and holding hearings and inviting comments. . . ."

"So far as parks are concerned, . . . our objective has been and will continue to be to avoid parks altogether at all levels of government if we can do it—state parks, county parks, regional parks, city parks—and if we can't avoid a park altogether, our objective has been and will continue to be to minimize any damage. . . ."

An important result of the meeting was the appointment of a permanent committee of two members of each commission for better liaison in the future between the commissions. Bradford appointed Highway Commission members Whitehurst and Woolley; Stern appointed Park Commission members Owings and Fleharty (latter not present).

Clockwise from center right: Harry Freeman, Deputy Director, Public Works; Carl Anderson, Beaches and Parks, and Fred Meyer, State Parks Forester; James Warren, Beaches and Parks; Dr. Ralph Chaney, University of California, professor emeritus, discoverer of "dawn redwood" in China.

Below: Overall view. Highway Commissioner William S. Whitehurst (upper row right) has joined meeting. Men in foreground are members of press. Above, right: Commissioner Elsbach answers question by pointing to Division of Beaches and Parks exhibits on wall.

LARTS Program

Phase One Completed On 9,000-square-mile Area

By J. W. SHAVER, Assistant District Engineer—Advance Planning

The greater Los Angeles area extends over some 9,000 square miles, encompassing three counties, a portion of two others, and 122 cities. Within this area live well over 7½ million people, whose collective transportation needs, both now and in the future, establish the pattern from which planners develop tomorrow's transportation facilities.

To determine what that pattern is—and why—is the mammoth undertaking of the Los Angeles Regional Transportation study, one of the largest cooperative efforts of its kind between federal, state, county, and city governments ever attempted. Under the general coordination of the Division of Highways, the study has been in progress since January, 1960, with the Bureau of Public Roads, the Housing and Home Finance Agency, the State Office of Planning, the Counties of Los Angeles, Orange, Ventura, San Bernardino, and Riverside, and the 122 cities within the area participating. The study will furnish valuable information about what the area's traffic needs will be in 1965, 1970, 1975, and years beyond. From these data, transportation planners on all levels of government will be able to develop transportation facilities to meet these needs and to integrate their plans with those of the other jurisdictions.

Visual renderings of LARTS data help transportation planners survey a situation at a glance. Looking over some LARTS maps here are District VII personnel (left to right) R. E. Deffenbach, District Engineer—Planning; Metropolitan District Engineer E. T. Telford, who is LARTS Study Director; John W. Shaver, Assistant District Engineer—Advance Planning; Gibson Fairman, District Planning Engineer—LARTS.

First Phase

Phase one of the LARTS program—a detailed examination of the area as it existed in 1960—has just been completed. In the process of analyzing 1960, the LARTS staff also undertook the basic job of developing and testing methods through which future vehicular movement can be predicted.

Through postcard questionnaires and interviews with the area's motorists at home, in the office, and on the roadside, the LARTS staff compiled information concerning present movement of people and goods in terms of origins, destinations, frequency, and lengths of vehicle trips. (This data-gathering process is described in a previous article on LARTS, *California Highways and Public Works*, January-February 1961.) To this were added socioeconomic details, including housing types, number of vehicles owned, and family income. Next came an inventory of residential, industrial, agricultural and other land uses throughout the area. Finally, the location and length of each segment of the freeway, highway, and major street network were determined, as well as the travel speed on each.

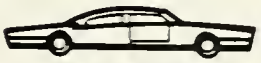
These raw data, when coded for electronic processing, filled 600,000 punchcards. If placed end to end, these cards would stretch 70 miles, or, if stacked, would reach the approximate height of a 35-story building.

Formulas Produced

From the analysis of this vast storehouse of facts, mathematical relationships between movements of people and land use were developed, and these formulas, collectively, are known as the "transportation model."

The transportation model is by no means a simple assemblage of traffic counts and origin and destination studies that show where people are going and in what volumes at what times. Rather it also scrutinizes the socioeconomic factors which induce people to travel and which influence the number, length, and purpose of their trips.

FACTS ABOUT LARTS STUDY AREA
1960



3,437,000
AUTOMOBILES

PLUS

409,000
TRUCKS

12,342,000
DAILY AUTO TRIPS

FOR

WORK	4,099,000
SHOP	1,890,000
OTHER	6,353,000

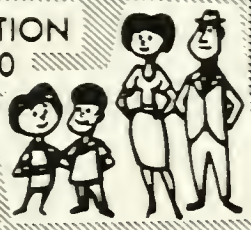
AVERAGE AUTO TRIP
6.1 MILES

1,803,000
DAILY TRUCK TRIPS

AVERAGE TRUCK TRIP
5.2 MILES

WHO DROVE

POPULATION
7,579,000

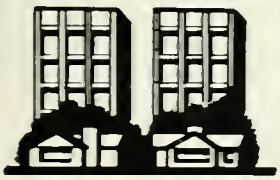


84,541,000
DAILY VEHICLE MILES

5,776,000
ACRES

VACANT
3,968,000
ACRES

568,000 APARTMENTS

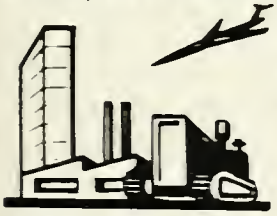


WHO LIVED IN

2,076,000 HOUSES

WHO USED
1,808,000
ACRES FOR

MILITARY
84,400
ACRES



WHO WERE
EMPLOYED IN

3,000,000 JOBS

AIRPORTS-RAILROADS-DOCKS
24,400
ACRES

STREETS AND HIGHWAYS
209,000
ACRES

AGRICULTURAL
849,000
ACRES

RESIDENTIAL
369,000
ACRES

COMMERCIAL AND PARKING
39,000
ACRES

INDUSTRIAL AND TRUCK TERMINALS
92,000
ACRES

RECREATIONAL AND INSTITUTIONAL
142,000
ACRES

An apartment house, for instance, generally produces fewer auto trips per day per unit than a single-family residence, the study shows. Areas housing lower income families generally produce fewer auto trips per household than areas of higher family income. As might be expected, the number of automobiles owned per family has the greatest influence on the number of auto trips made. Among other findings regarding length and purpose, it was found that the average shopping trip was considerably shorter than the journey to work. These and many other conclusions which were known or at least suspected qualitatively before have now been measured and quantified—and, more important, have been interrelated in a manner which is useful in predicting future traffic.

Auto Trips Analyzed

The LARTS transportation model analyzes automobile trips by five general types: home-work, home-shopping, home-other, work-other, and other-other. The three home-based types of trips account for 67.2 percent of all auto trips. The home-work trip, of course, accounts for most of the peak hour traffic. The "other" category includes trips which begin and/or end some place other than home, such as trips taken for business, recreational, medical, educational, or social reasons. Of all auto trips, LARTS discovered, 30.3 percent are of the home-other type, 21.7 percent of the home-work type, 21.5 percent of the other-other type, 15.2 percent of the home-shopping type, and 11.3 percent of the work-other type. Detailed information about the length, number and direction of these trips can be of value not only to transportation planners, but to other planners as well.

Another aspect of the transportation model important to planners is its ability to show the sphere of influence a particular business, shopping or residential area has in attracting traffic. When travel desires to and from a given area are plotted on a map, the visual result is a star-shaped pattern with beams spreading asymmetrically to show the number of drivers, the distances they travel, and the directions from which they come for various trip purposes (see illustration page 41). From such volume and direction patterns, transportation planners can quickly assess traffic needs.

Techniques Tested

The validity of these techniques and of the many others that make up the LARTS transportation model was tested to insure that the model would be a useful predictive tool. Ground traffic counts were taken along nine screenlines in the LARTS area and were compared with the traffic that had been computed mathematically. The computed counts average only 7 percent higher than the actual counts, indicating a good level of accuracy for the model.

The model, however, is not to be treated as static. If, for example, trip lengths become longer or shorter in

Concentration of population in the LARTS study area is shown in the above map.

AUTO DRIVER TRAVEL DESIRE PATTERNS FOR A RESIDENTIAL ZONE

WORK TRIPS

SHOPPING TRIPS

TOTAL TRIPS

the future, or if higher incomes and shorter workweeks prompt fewer business trips and more social or recreational trips, these trends will be incorporated.

With a workable model at hand, the LARTS staff is now beginning phase two of the program—the allocation of population, employment and land use for 1980 to traffic zones from information provided by the participating cities and counties.

While the primary objective of phase one was to establish a sound predictive tool, a valuable byproduct to government planners was the detailed analysis of the LARTS area as it existed in the 1960 base year. In that year, the study area contained about half of California's population and over 4 percent of the nation's population. Nearly 90 percent of the area's population was in Los Angeles and Orange Counties, and the population had more than doubled during the previous decade.

Over 23 percent of the families in the area had annual incomes over $10,000. By comparison, less than 22 percent of California's and about 15 percent of the nation's families were in this category in 1960. As might be expected, LARTS maps show a striking similarity in the geographic distribution of family incomes and number of cars owned.

'Old People' Theory Exploded

It is sometimes thought that the average age of Southern Californians is much higher than the rest of the nation's, but LARTS findings do not confirm this. While milder climate does attract older people, the study suggests that increased economic activity has caused immigration of large numbers in the family-forming, childbearing age brackets between 18 and 35. In 1960, median age in the LARTS area was only 30.6, which is not much higher than the national median of 29.5, or the California median of 30.0. Further, the LARTS percentage of population over 65 was 8.9, a notch lower than the national average of 9 percent and a notch higher than the California average of 8.8 percent.

Of 5,776,000 acres in the study area, approximately 69 percent or 4,000,000 acres were vacant, of which 2,800,000 are probably unusable. About 850,000 acres were devoted to agriculture, 87,000 to recreational facilities, 39,000 to commerce, 92,000 to industry, and 369,000 to residential use.

Population Density

The net population density was about 20.5 persons per acre of residential land, excluding streets. With residential streets included, the density drops to 16.5 persons per acre. Single-family housing accounted for over 75 percent of all housing units. In recent years, however, the percentage of new multiple housing units has increased sharply. In 1958, for example, the net increase of multiple units in Los Angeles County exceeded the net increase of single family dwellings for the first time.

Average miles traveled on a weekday in LARTS area were 88,100,000 in 1960. "Long" trips, those exceeding 26 miles, were 4.2 percent of total trips, but accounted for 19 percent of the miles driven.

LARTS findings reiterate that freeways can handle more traffic at higher speeds than conventional highways. This is reflected in the fact that freeways, which are only 5 percent of the total lane miles in the LARTS area, carry 24 percent of the total vehicle miles, at an average speed of 49.7 miles per hour in comparison with average nonfreeway speeds of 28 miles per hour.

Statistics such as these are only a small portion of the 1960 data available to participating local governments right now. Much other detailed information on land use, employment, trip production, trip distribution, traffic volumes and other categories is also available, together with staff assistance in the interpretation of them. And within the next year and a half, when the study's second phase is tentatively scheduled for completion, LARTS will become even more important to transportation planners on all levels of government as it supplies a forecast of 1980 transportation requirements.

Glendale Report

Preconstruction Study Shows Freeway Benefits

Summation By STUART L. HILL, Headquarters Right-of-way Agent

Real estate activity in Glendale has doubled since the adoption of a route for the Ventura Freeway through the city. Even though the freeway isn't built yet, properties close to the proposed route have increased in value by 40 percent since 1959; by comparison, properties in the rest of the town have only increased 20 percent. This price increase reflects the development of an intense demand for property along the proposed route—a demand which anticipates the benefits of freeway construction by many years.

The Glendale study reveals that (1) older and well-established suburbs benefit as much from freeways as the new suburbs on the urban fringe, and (2) as soon as a route is adopted, the community begins to experience the economic benefits that are associated with freeways.

The beneficial effect of freeways upon real estate activity in the urban fringe has long been recognized. In Southern California, the urbanization of Orange County and the San Fernando Valley are classic examples of the economic benefits that accompany improvements in the transportation system. Freeways here have meant new homes, new apartments, new shopping centers, new industry, new recreational uses. Freeways have provided the means for extending the whole gamut of urban land uses to areas which were formerly too remote to play a role in our midcentury population explosion.

Some Changes Overlooked

While we have concentrated our attention upon the spectacular changes that have occurred in areas such as Orange County, we have overlooked some equally spectacular changes that have been occurring in the older suburban areas, such as Glendale, which are much closer to the central city. To the casual observer these changes don't appear to be as spectacular. We don't see vacant land transformed—almost overnight—to new subdivisions, supermarkets, schools. The changes are less perceptible because they occur in an area that is already devoted to urban uses.

Location of the proposed freeway through Glendale is shown in the above map. For purposes of study the community was divided into six bands or zones designated as Areas A, B, C, S, D, and E proceeding from south to north.

The adoption of the Ventura Freeway (Route 134) through the City of Glendale has offered the Division of Highways a unique oportunity to study and understand some of these changes. Glendale is an excellent community to study because it is relatively homogeneous and neighborhood patterns tend to be very well defined.

Twenty years ago, Glendale was often referred to by radio comedians as a conservative, if not stodgy, town that rolled up its sidewalks at nine o'clock every night. Today, however, this town is taking very progressive and vigorous steps to cope with the modern problems of an urban community.

Glendale has always been essentially a residential community with

the vast majority of its residents commuting the 8 to 10 miles to Los Angeles daily. Nearly everyone lived in and owned their own home. Glendale's character was set during a time when home ownership was much more difficult to achieve than it is today. The town had an excellent school system and took pride in having more churches and fewer bars per capita than most comparable communities. In an era of "classness" Glendale offered an attractive atmosphere for the average middle-class family seeking a stable environment.

Population Increase

The population of Glendale in 1963 is estimated to be 129,187, up about 8 percent from the 1960 census figure of 119,442. The 1950 census counted 95,702 people in the city limits. Glenday, today, is the third largest town in Los Angeles County, and, if present trends continue, its 1980 population may approach 190,000.

The commercial center of the town is traditionally located at Broadway and Brand, although it has tended to gravitate one block north in recent years to Brand and Wilson. Brand Boulevard is the prime retail street. Central Avenue, Glendale Boulevard, Broadway and Colorado Boulevard also have many retail outlets which vary from neighborhood stores to multimillion-dollar enterprises such as Robert Wian's "Bob's" drive-in restaurant and food industry complex. There are numerous other retail stores scattered about the remainder of the city serving local trade. Manufacturing is generally confined to the strip along San Fernando Boulevard and on the site of the former Grand Central Airport just north of the Golden State Freeway.

In a very general manner, excepting the portion around the "old" and "new" downtown, the residential portion of the community has developed in bands from south to north. The most striking line of demarcation is "The Wash" which generally parallels Glenoaks Boulevard. (The northern line of area "S" on the map approximates this line.) North of this line most of the homes were built from 1938 to 1950. South of this line, most of the homes were built prior to 1935.

Marketability Affected

The general small size and increasing age of the homes south of "The Wash" created a problem for the continued development of the community. The ease of owning new and modern homes in the more remote suburbs severely affected the marketability of these homes. They could not attract a sufficient number of new residents to renew the vitality of the area, and the homes and the area began to deteriorate.

The City of Glendale, anticipating this trend, sought to renew the area by zoning most of the properties south of "The Wash" for multiple residential use. Zoning itself, however, wasn't enough to turn the tide. Some new investment occurred, but it was on a very small scale, insufficient to generate much further investment. During this period even the best real estate salesmen went through some very long, dry spells.

However, in February 1961, with the adoption of a freeway location for Route 134, several blocks south of and parallel to "The Wash," the real estate investment picture in Glendale changed radically. Sales activity increased 100 percent; the number of new multiple units constructed doubled. The transition that the community looked for began to take place, and the entire town entered a new period of rejuvenation.

Investors Anticipate Benefits

Almost immediately the Division of Highways began to follow the changing pattern of activity. Our experience has indicated that shortly after route adoption *the benefits of freeway construction are anticipated by private investors*; frequently, by the time actual construction is completed, the effects have become so diffuse that an analysis before and after construction does not completely reveal impact. The Glendale study is a long-range study, then, beginning two years before route adoption; it will end several years after the facility is opened to traffic—sometime in the early 70's. This progress report will cover changes in the real estate market which have occurred in 2½ years after route adoption, i.e., up to July 1963.

Study Zones Described

For the purposes of study the community was divided into six broad bands or zones which roughly correspond to zoning and clusters of similar neighborhoods. These are shown on the accompanying map designated as Areas A, B, C, S, D and E, proceeding from south to north.

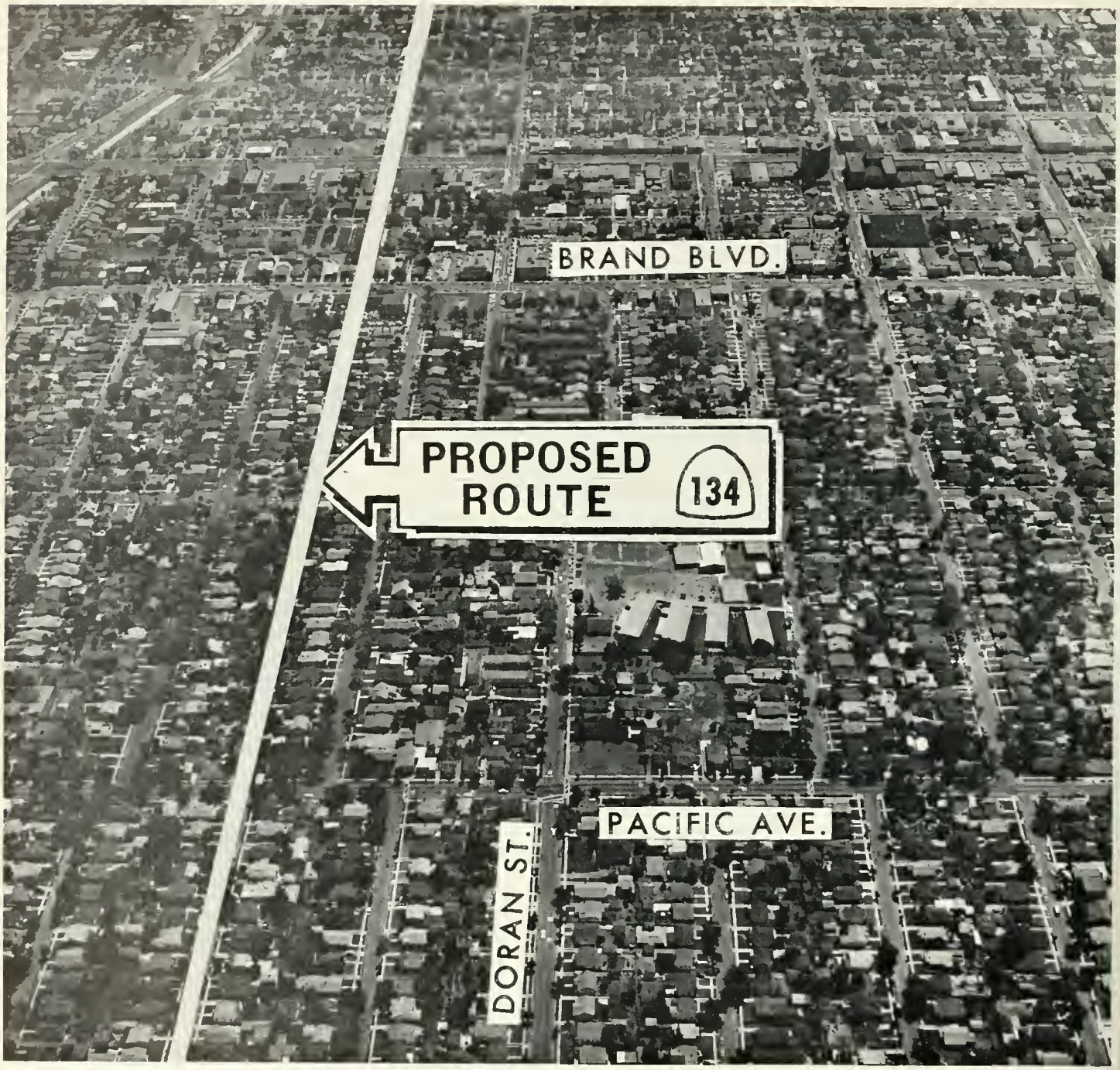
Area S is a special study area which generally parallels the adopted freeway route two blocks on either side. Except for study purposes, this area is the same as Area C. Areas B and C are predominantly older frame or Spanish style single family residences but zoned for multiple residential (R-3 and R-4).

Some portions of Area A are similar to Areas B and C, but the majority of this area is composed of a residential area known locally as "Adams Hill." This portion of the area is zoned for single-family dwellings only (R-1), and is not likely to change use in the foreseeable future.

Area D is the prime R-3 and R-4 area. This area is principally improved with multiple dwellings and has been a good investment area for 20 years. Its strategic location next to a prime R-1 residential area (Area E) has always made it a desirable location for rental property.

Area E is the prime residential area in the city. Zoned for single-family dwellings, this area has been very desirable since its development in the late 30s. Along the foothills on the north, the area becomes quite exclusive, and a good many celebrities live or have lived there.

Area F (not shown) is separated from the rest of the town by a manufacturing zone. This area is so small, its character so different and sales so few, that it was eliminated from the study at this time. There are other areas within the city limits that have been excluded from the study. For example, all neighborhoods north of Mountain Street were eliminated. These are essentially high-value neighborhoods, some approaching estate size. Generally, the study only considered those single-family dwellings with a value below $36,000—confining itself to the "middle class" homes that are more subject to the vagaries of the real estate market. In the neigh-



The location of the proposed freeway through Glendale has been indicated in the above aerial by a white line.

borhoods north of Mountain Street, it was felt that the bulk of the homes would exceed this arbitrary mark. This cutoff line eliminates neighborhoods known locally as Rossmoyne, Verdugo Woodlands and the "Annex" north of the Verdugo Mountains. It is felt that this elimination does not significantly affect the results of the study.

Through the cooperation of the City of Glendale and local realtors, principally La Chasse Realty, we were able to collect over 2,000 individual sales of residential parcels that had occurred between January 1959 and July 1963. Analysis of these sales has revealed the startling pattern of freeway impact.

The 2,000 sales collected are those properties that were sold through the multiple listing service and represent approximately 50 percent of all the residential sales that occurred within the community. Approximately one-third of the sales collected occurred during the 2-year "before" period; while the remaining two-thirds occurred in the 2½-year "after" period. Since multiple listings have tended to remain at a fairly constant proportion of total sales, this indicates, roughly, the change in activity that followed route adoption.

Although changes in sales prices of apartment houses will be indicated,

this study will concern itself principally with changes in value of single-family dwellings—and those primarily on R-3 and R-4 lots.

Average Sales Compared

Comparing the average sales price during the before period to the after period reveals that the average home in Glendale was selling for a price 11.5 percent greater during the after period. Additionally, comparing the average sales price in 1959 to the average sales price during the first half of 1963, we find that the average home increased in value by better than 20 percent.

Graph 1 shows how the various areas have changed; comparing the average sales price during the entire before period to the average sales price price during the entire after period, this chart shows the percent increase during the after period. Note that the area which showed the greatest relative increase in Area S, our study area extending two blocks on either side of the proposed freeway. In the before period the average home in Area S was selling for $15,900—in the after period it was selling for $18,850, an increase of better than 18 percent. Combining the two areas on either side of Area S, i.e. Areas C and D, we find that in the before period the average home was selling for $15,700 and increased to $17,650 in the after period—a change of 14 percent. In other words, homes in the study zone were worth an extra $1,000 after the route adoption.

Even more startling, comparing the average sales price in Area S in 1959 to 1963, we find an increase of better than 40 percent—double the rate of increase in the rest of the community. For example, again combining Areas C and D, the '59 to '63 increase is only 15 percent.

Apartments Replace Older Homes

These relative price gains reflect the changes that are now taking place in the City of Glendale, and the freeway effects that the residents there have long since recognized. The older homes in Area S are now being torn down to make room for new apartment buildings. Construction activity in this area has increased at a tremendous rate. As a matter of fact, when

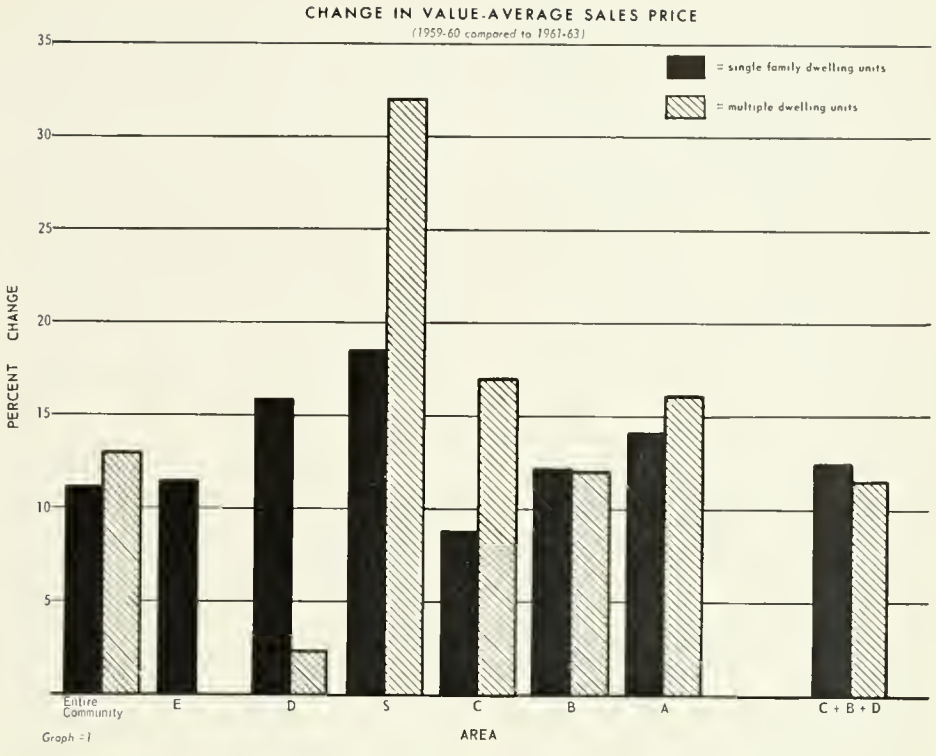


TABLE I

BUILDING ACTIVITY IN GLENDALE

Multiple Dwellings Containing Three or More Units per Site

Year	*Number of permits issued*	*Number of family units*	*Total value of permits*
1959	87	not available	$5,000,000
1960	84	992	5,600,000
1961	145	1700	12,600,000
1962	199	2265	18,000,000
1963 (first half)	100	989	8,800,000

these older properties are advertised in the newspaper for sale, they are no longer listed as *houses* for sale, but in the section carrying ads for *lots*.

An indicator of this change is the number and value of building permits for new multiple dwelling units during the before and after period. Table 1 shows the change that has occurred in this activity. Note especially that the value of permits issued in 1961 was double the value of permits issued in 1960 and the value was another 40 percent greater in 1962. Note, also, that the number of family units involved in the first half of 1963 was as large as the number of units during the entire year of 1960.

Generally, the variation in the average price of multiple units shown on Graph 1 reflects this activity also. The increase in Area S shown on this chart is a reflection of the sale of new apartment buildings—buildings that didn't exist in the before period. The greatest increase is shown in Area S because the greatest number of new multiple units have been constructed within this area.

Sales Are Compared

Our analysis of the sales also revealed another relationship which tended to describe the transition in Area S. Graph 2 shows the change in average price in the various areas comparing the before period to the after period. It also shows the 68 percent range. That is, 68 percent of the properties sold within the range indicated by the length of the line. It is interesting to note that, consistently, the high point of the range increased at a

greater rate than the mean or low points—and the low point of this range increased at the slowest apparent rate. This tendency was confirmed by an analysis of double sales, i.e., properties that sold twice or more during the study period. There was a definite tendency for higher value properties to increase in value at a faster rate than lower value properties.

This tendency is related to the transition of the area to multiple residential. For example, higher valued properties, where the house has little economic utility, are, generally, the larger parcels—over 7,000 square feet. The lowest valued properties tend to be under 4,000 square feet. The larger parcels which will hold the larger, and more economically operated, apartment houses, have therefore been in greater demand and show a greater relative increase in value. The highest demand for such parcels, and hence, the greatest value increase, has occurred in Area S, the study area adjacent to the freeway.

The freeway, then, has significantly benefited the City of Glendale. It has helped the community fulfill the goals that it set for itself when it zoned the residential area south of "The Wash" for apartments. While the area adjoining the proposed facility was in transition prior to freeway route selection, it did not really come into its own until the freeway route was adopted.

Effect on Established Community

The Glendale study has thrown some light on another problem area—the effect of a freeway upon an established community. On occasion at public hearings prior to route adoption, residents of a community will express the opinion that a new freeway through the community will "spoil" the entire town. If it is a well-established middle class, residential community such as Glendale, the residents are especially anxious. Having lived in the town a good many years, they may feel that a change such as a freeway is too drastic for their community to withstand. Sometimes, statements are made in this context which indicate that the residents feel that the value of property in the entire town will decrease as the result of the freeway and the new environment which it creates.

In Glendale we have the opportunity to investigate this fear—at least in regard to the period immediately following route adoption when the "look" of the freeway is still unknown and may cause irrational fears. Area E is in close proximity to the proposed freeway. In some cases it even abuts the route. This area, as we have stated, is a substantial and well-established group of neighborhoods composed almost entirely of single-family dwellings.

In 1959 the average home in this area was selling for $20,640; 68 percent of the home sold within the range of $16,000-$25,200. In the first half of 1963, two years after the route adoption, the average home was selling for $24,875 while 68 percent of the homes, sold within a range of $20,250-$29,450 — an increase in average value of 20.47 percent. (Within this range it is apparent that our arbitrary elimination of homes and neighborhoods over $36,000 may have tended to lower the mean and real average—e.g., in 1959 in neighborhoods where sales over $36,000 were collected but eliminated, sales in this category amounted to 3.14 percent of the total—in 1963 they amounted to 9.0 percent.)

No Panic Selling

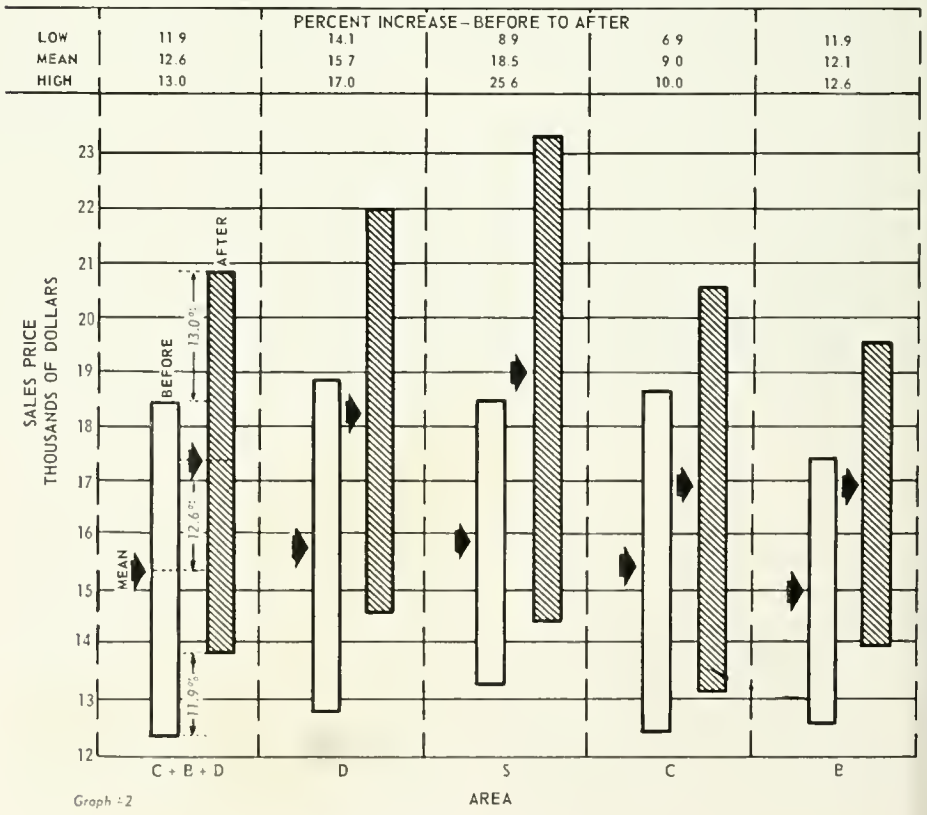
In Glendale, then, there was no panic selling at lower prices, but, on the contrary, a 20 percent increase in value in 4½ years. The contention that freeway proximity may ruin substantial middle class neighborhoods seems to be untrue.

In order to further refine our measurement of freeway effects, however, it is necessary to have some sort of control area to compare, as we had for Area S. In other words, how much of the increase can be ascribed to the proposed freeway? Does this growth rate represent a benefit to the area through potential improved accessibility, or does it represent a disbenefit through proximity? The test is a comparison to another similar area. If the other area is growing faster, then there is a disbenefit; if it is growing at a slower rate, then there is a benefit.

The control area in this case is Area A, the R-1 portion known as Adams Hill. The area is generally middle class, and although many

AVERAGE AND RANGE OF SALES PRICES — GLENDALE

(Single Family Dwellings on Lots Zoned for Multiple Dwelling Units)



Graph 2

homes on the hillside have views, is not considered quite as desirable as Area E. This area is roughly two miles south of the proposed freeway, and consequently closer to Los Angeles. Since the freeway will not serve to bring the Adams Hill area in closer proximity to the central area, it should be out of the area of freeway influence.

Average Value Increase

Considering only those properties zoned for single family residential use, in 1959 the average home in Area A sold for $16,540; 68 percent of the homes sold within a range of $13,500–$19,550. In 1963 the average home was selling for $19,925, while 68 percent of the homes were within a range of $15,300–$24,000. This represents an increase of 20.52 percent in average value.

Since both areas have increased their values 20 percent we conclude that the freeway has had no effect upon single-family residential neighborhoods in Glendale. There is neither a benefit nor a disbenefit apparent at the present time.

The Glendale study, as an analysis of the effects of a freeway through a suburban residential community, is not complete. It cannot be complete until several years after the freeway is opened to traffic. Only then will we have the opportunity to evaluate the effects of actual construction—the improvement in accessibility. Nevertheless, at this preliminary stage we have gained valuable information.

It is generally agreed that the value of a parcel of land depends, among other things, upon its accessibility to a community economic center. The improvement of accessibility, such as by construction of a freeway, has inevitably increased the value of abutting land in suburban areas. In the case of Glendale, accessibility has not yet been improved. Nevertheless, there has clearly been an increase in land values which can only be attributed to the proposed freeway. It is clear that investors anticipate the change of accessibility that follows freeway construction. Money begins to be invested, and demand increases many years prior to actual construction.

Area Ripe for Investment

In the case of Glendale the area immediately surrounding the freeway was ripe for new investment. The homes themselves had depreciated in value beyond economic utility, the property was properly zoned for upgrading the use, and the adoption of a freeway route promised future benefits to the area in terms of accessibility. The freeway served as a tool for the acceleration of a change in land use. There is little doubt that the change to multiple residential use would have occurred eventually, but the freeway acted as the catalyst to set the change in motion at a faster pace and at an earlier date.

The freeway in Glendale has had the same general effect upon that community as the Santa Ana Freeway has had in Orange County. It has increased the intensity of use of the land. The population density has increased, but on a different scale and through a different land use. It is clear that the major difference between the established suburbs such as Glendale and the newer areas such as Orange County is that in Glendale where some sort of transportation system preexists, investors do not have to depend upon the actual construction of the route to attract new people. The mere adoption of a route and a tentative construction date in a proper zoning environment is sufficient stimulus to benefit the community and to effect the changes indicated here.

Future Studies Indicated

Furthermore, it is equally clear that our continuing analysis of this community will present us with some difficult problems. With the passage of time, the new apartment construction will tend to have an impact of its own—to attract other new investments to areas contiguous to it. The effect will slowly spread through the entire R-3 and R-4 area. (A preliminary look at the data for the second half of '63 seems to confirm this impression.) Our future studies will find it difficult to locate control areas and to sort out the effect of the freeway after construction. If we had confined this study to two years before and two years after actual construction, we would have been hard pressed to find any effect at all. By the time the freeway is actually open for traffic, most of the development and change to multiple residential will have already occurred and a study initiated at that late date might show only imperceptible and inconclusive changes.

We will continue, however, to collect data on Glendale and to probe the changes that occur until after the route is opened for traffic. It is clear that the results of this study and a more intense evaluation of the data collected will ultimately prove to be a valuable tool in planning future transportation improvements.

Drilling Crew Saves Home in Glendale

A Materials and Research Department foundation drilling crew working in the Glendale area aided a potential fire victim in saving his home from a fire raging in the area on the morning of March 16.

The crew, consisting of Floyd Strickler, drilling foreman, Henry A. Williams, James T. Lupo, and Rupert E. Day, foundation drillers, were core drilling in the Glendale area for information on cut slopes.

The crew were at breakfast when they first heard of the fire and hurried to the drill site, arriving about 6.45 a.m. They began packing equipment and preparing the drill rig and all vehicles for travel. By the time they had traversed a dirt road through the brush to a cleared area, the air was hot and smoky. At that time the fire was burning at the edge of this cleared area.

Observing a man attempting to wet down the house nearest to the cleared area with a garden hose, the crew used a hose from their drilling equipment, connected it to a fire hydrant and sprayed the house until the nearby brush had burned itself out. The only fire loss was some lawn furniture. In the process of fighting the fire, the crew suffered severe eye irritation from smoke and cinders, which necessitated medical treatment.

Bay Bridge Reconstruction

By E. R. FOLEY, Chief Engineer, Division of Bay Toll Crossings

The reconstruction of the San Francisco–Oakland Bay Bridge to provide five lanes of one-way traffic on each deck has been the subject of two previous articles in *California Highways and Public Works*. They appeared in the July-August 1960 and January-February 1962 issues.

This article describes the final phase of structural modifications before one-way traffic movements could be instituted. It covers strengthening of the upper deck on the East Bay spans; construction of refuge bays; resurfacing of the upper deck; additional reconstruction on the approaches; lower deck lighting; and signs.

Upper Deck Strengthening

The upper deck of the Bay Bridge was originally designed to carry passenger automobiles and light commercial vehicles on six traffic lanes, three in each direction. In the East Bay spans, defined as that portion of the bridge east of Yerba Buena Island, the floor system consisted of a reinforced lightweight concrete roadway slab six inches in depth and 58 feet wide. This was supported on transverse joists at six-foot centers which in turn rested on four longitudinal stringers spaced at 16-foot centers. These longitudinal stringers were framed into floor beams having variable spacings as indicated in the following tabulation:

Type of span	*Spacing, feet*
288-foot and 292-foot deck trusses	36
504-foot through trusses	42
Cantilever—anchor arm	48
Cantilever—cantilever arm	55
Cantilever—suspended span	58

Analysis of this floor system indicated that all of its elements, that is, the roadway slab and its supporting structural steel members were inadequate to carry the heavier live load that would be imposed when unidirectional traffic movements were put into operation. A strengthening method had to be devised which would not interfere with passage of the more than 110,000 vehicles using the bridge each day. After consideration of many different plans and alternatives, the upper deck floor system of the East Bay spans was strengthened in the manner described in the following paragraphs.

Raadway Slab and Transverse Jaists

To reduce the span of the roadway slab and the load carried by each of the existing joints, intermediate joists were installed at six-foot centers midway between the existing joists. The new joists are 10WF sections of A440 high-strength steel.

The rolled sections were threaded in one piece through the space between the existing longitudinal stringers and the concrete slab. The joists were preloaded at the third points of the spans between

These internally lighted directional signs on the San Francisco end of the bridge have proven quite effective for nighttime visibility. The color scheme used corresponds to that established by interstate highway standards.

stringers and at the ends of the joists to insure their full participation in carrying the live loads. High-strength bolts were used to connect each joist to the top flange of the stringer. The void between the joist and slab, varying between one-half to one inch, was filled with a 1:3 grout mixture, applied as air-blown mortar. The grout contained an admixture to prevent shrinkage.

Stringer Strengthening

The load-carrying capacity of the existing longitudinal stringers was increased by the addition of understringers. Both rolled and welded sections were used.

Sections were fabricated in such a manner that either their natural camber or a specified camber could be erected upwards.

The understringers were lifted and clamped into position. Then, using the predrilled holes in the understringer as a template, holes were drilled through the bottom flange of the original stringers. High-strength bolts, ⅞-inch in diameter, were installed and tightened in a sequence progressing from the ends of the understringer towards the center to complete erection.

Floor Beam Strengthening

The floor beams of the East Bay spans were strengthened in the same manner as those on the West Bay spans. A high-strength steel plate was bolted to the bottom flange of each beam after the plate had been stressed to a predetermined amount. Using this method of strengthening, the tensioned cover plate induces an initial compressive force on the bottom flange, thereby reducing the existing dead load tensile stresses. Thus, a greater portion of the strength of the original section is made available to carry increased live load.

The procedure for installing these cover plates was similar to that described in the article of January-February 1962.

Minimum Traffic Interference

In the preparation of construction contracts, serious consideration was given to details which would offer the least interference to the movement of bridge traffic. On the East Bay work, the State's traveling scaffolds were available for use by the contractor. These were augmented by his own scaffolds. Also, the contractor was permitted to use the south lane as a working area. This arrangement caused a minimum of inconvenience to traffic while reconstruction of the East Bay spans was accomplished.

As a result of strengthening the upper deck floor system in the East Bay spans the entire upper deck is now capable of carrying five lanes of H20-S16 traffic with maximum stresses not exceeding those allowable in the current edition of the American Association of State Highway Officials Standard Specifications for Bridges.

Refuge Bays

The capacity of a long structure, such as the San Francisco–Oakland Bay Bridge, is directly related to the continued movement of traffic. Thus any stalled or disabled vehicle reduces its capacity. To keep the large volume of traffic on the bridge moving, refuge bays have been constructed wherever possible. In the East Bay spans these were built in the curved sections of the bridge: first, in the area west of the cantilever span, and second, just east of the 504-foot truss spans. These refuge bays were built by moving the existing curb back and paving the area with lightweight conrcete.

Upper Deck Resurfacing

Resurfacing of the upper deck was considered necessary for two reasons. First, after nearly 27 years of use the concrete surface was beginning to show signs of wear, particularly in the curb lanes. The degree of deterioration was such that it was considered advisable to repair the deck before heavier loads were imposed upon it. Second, it was necessary to cover the 4" x 4" tiles which had been embedded in the concrete roadway to delineate the six traffic lanes.

Since the amount of dead load that could be added to the structure was limited, investigation was concerned with a lightweight material, that would provide a long, serviceable life. An epoxy coal tar compound met these requirements; it weighed 15 pounds per square yard at a ⅛-inch thickness, its serviceability was considered good, and it could be easily applied.

Resurfacing Operations

A total of 26 lane-miles of resurfacing was accomplished on the upper deck. The first step in the resurfacing process was to patch cracks and deteriorated areas wtih epoxy grout, followed by a sandblast cleaning of the deck. After this a special tank truck spread the epoxy coal tar compound

Hump Looks Good In Retrospect

Reprinted from the San Francisco *Examiner* of Jonuory 17, 1964

The new one-way traffic patterns on the Bay Bridge, in effect since mid-October, have more than proved in practice the expectations of the State Division of San Francisco Bay Toll Crossings.

Traffic smoothed out quickly and flowed faster after the changeover, made possible by converting each deck to a one-way street. Notable, too, is the fact that no fatalities have occurred on the bridge since the changeover. Credit this to elimination of head-on collisions. The old two-way routing had a sanguine history.

All these facts stand out impressively against the background of abuse heaped on the division, and particularly on the division chief at the time, Norman C. Raab.

The beating Raab took from angry commuters and caustic critics during the days of "The Hump" seems in retrospect, and in the light of subsequent usefulness of the project, to have been of shallow substance. The Hump was necessary to permit raising of the upper deck to give adequate clearance to heavy vehicles. Commuters were discommoded. Construction delays were numerous. Tempers wore thin, as did public patience.

But disruption and inconvenience were unavoidable. The only alternative would have been to close the bridge.

We suspect a lot of people would like to take back the harsh things said about Norman Raab in connection with irritations caused by The Hump. Raab stepped down as division chief last July 31, after 40 years of state service, including many important contributions to California's system of bridges. The Hump was one of several thorns in his side accumulated over the years—the least deserved one, as experience with the one-way traffic on the Bay Bridge is proving every day.

The completed upper deck strengthening as seen from below on the lower deck showing the additionol transverse joists, understringers, floor beam coverplate and typicol lower deck lighting installation.

Upper deck traffic after change to one-way operation.

on the deck. The resin was filled immediately with a fine, hard, dust-free aggregate, which resulted in a nonskid surface. The aggregate was shoveled from trucks in the adjacent lane.

The distributor truck was provided with separate tanks to hold the two components of the epoxy coal tar compound. Volume and temperature controls were both critical. The distributor was especially designed to handle the mixture used.

Traffic

As was the case in all other work performed on this project, disruption of the heavy Bay Bridge traffic was held to a minimum. To avoid hindrance to morning and evening peak hour movements, the contractor's operations were limited to the hours between 8.30 a.m. and 4 p.m. After the morning rush hour, the two lanes required for the contractor's operations were blocked off. Before the evening rush, all equipment was removed from the deck, with only that portion of the roadway surfaced that day closed to traffic. About one lane-mile of deck was surfaced each day. It required from 3 to 12 hours for the epoxy coal tar mixture to set, depending upon the temperature. The paved area was opened to traffic the next day, after the excess aggregate had been removed and temporary lane stripes installed. The resurfacing operations on the upper deck caused little inconvenience to the traveling public, and the resulting improvement will benefit the users for many years to come.

Lower Deck Lighting

The lower deck, as originally constructed, was divided for use by two different types of transportation. The northerly portion was surfaced for motor vehicles. The southerly portion carried railroad tracks for electric trains. Sodium vapor lights, similar to those on the upper deck, were in place on the northerly side. No lights were installed in the area where the electric trains operated.

Since the existing lighting was inadequate for the new traffic pattern, it was decided to install a modern highway lighting system that would complement the new lower deck roadway.

Lower deck lighting on the West Bay spans.

Fluorescent lighting was selected for the following reasons:

1. The existing sodium vapor lights and fixtures are obsolete and are no longer manufactured except on special orders and at premium prices.
2. Fluorescent lamps are economical with respect to (a) initial cost, (b) operating costs, and (c) lamp life (up to 10,000 hours).

The new lower deck lighting consists of two lines of fluorescent fixtures installed in alternate panels. In the West Bay spans the fixtures are attached to the stringers while in the East Bay spans they are fastened to the floor joists.

The new lighting on the lower deck of the Bay Bridge is in accordance with the latest practice for highway lighting. The average illumination is approximately three foot-candles as compared to 0.5 foot-candle on the upper deck.

Approaches

Before one-way traffic could be instituted it was necessary to provide some means for buses to reach the Transbay Transit Terminal from the upper deck of the bridge. This access was provided by raising the existing Fremont Street off-ramp to the same grade as the Terminal roadway.

To accomplish this required the demolition of a portion of the existing structure and construction of a ramp at the new elevation. It was extended to cross over First Street and terminates at Fremont Street. This change permitted traffic leaving the bridge to move into the one-way pattern on Fremont Street, which leads directly into San Francisco's financial and business districts. It also eliminates a traffic light on First Street, a cross-town, one-way artery.

Yerba Buena Island Approaches

The existing approaches on the west side of Yerba Buena Island were constructed as a part of the access roads to the Golden Gate International Exposition, which was held on Treasure Island in 1939 and 1940. They were considered temporary and were to be removed at the conclusion of the Exposition.

With the advent of World War II and the establishment of the Navy base on Treasure Island, the approaches continued in use over the intervening years. However, these temporary approaches were inadequate for today's usage, particularly the ramp leading from the upper

Lower deck lighting on the viaduct section of the East Bay spans looking west toward the tunnel.

The control panel of a special truck for placing epoxy coal tar material. Gauges indicate pressures and temperatures of each mixture as well as the mixing chamber.

Equipment train for resurfacing the upper deck. The special truck for placing ⅛-inch-thick epoxy coal tar is in the lead followed by fine aggregate truck.

deck. A new steel structure with concrete deck was built to allow San Francisco-bound traffic to reach the upper deck. Access from the lower deck for eastbound traffic was constructed at grade.

Overhead Signs

The newly reconstructed bridge, with one-way traffic on each deck, required the installation of adequate signs to inform the motoring public. Internally illuminated overhead signs were chosen. Selection of the type of structural framework and the style of the signs was based primarily on aesthetic considerations. Colors used for the panels conform to standards for the interstate highway system.

Locations were carefully selected, particularly on the West Bay spans, where the effect on the view from the bridge into the City of San Francisco was of major importance. The internally illuminated signs present a pleasing addition to the bridge, especially at night.

One-way Traffic Instituted

On October 12, 1963, unidirectional traffic movements were put into effect. This was almost five years after the beginning of reconstruction on the San Francisco approaches, and one month less than 27 years following the opening of the bridge to vehicular traffic on November 12, 1936.

During the short period in which one-way movements have been in operation, there is ample evidence that motorists are now enjoying a faster and safer trip. The speed limit has been raised from 35 on the lower deck and 40 on the upper deck to 50 miles per hour, and traffic has been flowing evenly, secure in the knowledge that head-on collisions are no longer a major hazard on the bridge.

The California Highway Patrol recently issued a statement that statistics indicate that accidents have decreased by 32 percent, with 52 percent fewer injury accidents and no fatalities. Added to this is the comfort experienced in using the wider traffic lanes. The driver is relieved of the tension that was brought about by negotiating the narrow nine-foot eight-inch lanes that formerly existed on the upper deck.

. . . Continued on page 59

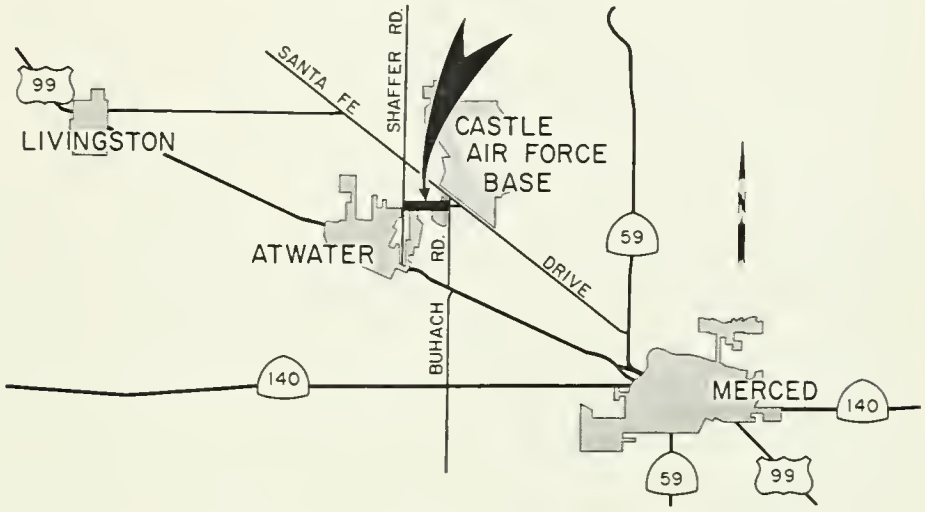
Bellevue Road

Merced County FAS Route Is Widened, Bridge Replaced

By VERNE L. DAVIS, Road Commissioner, Merced County

Castle Air Force Base, present home of the Strategic Air Command's 93rd Air Bombardment Wing, was activated in December 1941. With the growth of the Air Base, the surrounding area, including the Cities of Merced, Atwater and Livingston, also grew at a rapid rate because of the proximity of this vital defense installation.

During the past 20-plus years, many of the roads leading to the air base have been reconstructed and improved to satisfy the demands of the traffic volumes generated by the defense installation.



The Bellevue Road project is located between Atwater and Castle Air Force Base.

Looking east along the completed Bellevue Road improvement at the Livingston Canal crossing.

The east end of the project at the intersection with Buhach Road. The view is westward.

Work Completed

On July 1, 1963, work was completed on the reconstruction of Bellevue Road, FAS Route 1354, the most recently improved artery to the air base. The start of this construction culminated 18 months of coordinated negotiations, planning and design work between the City of Atwater, the County of Merced and the Division of Highways.

The length of the completed project is 1.05 miles, with the westerly portion from Shaffer Road to the west bank of Livingston Canal being within the City of Atwater. The existing narrow two-lane road and the bridge across Livingston Canal were entirely inadequate for the traffic volumes. High peak hour volumes required additional traffic lanes; therefore, a four-lane undivided 64-foot roadway between concrete curbs, within an 84-foot right-of-way was constructed.

Bridge Replaced

The substandard timber bridge across Livingston Canal was replaced with a concrete structure of full roadway width plus five-foot sidewalks and steel railing on each side.

Rights-of-way were acquired by the city and the county in their respective areas.

The total cost of the improvement was approximately $179,000, financed with federal aid secondary and state matching funds, City of Atwater ½-cent gas tax funds, and County of Merced funds.

Personnel from both the county and the State provided construction engineering and inspection under the direction of Melvin B. Rowan, resident engineer. Standard Materials Company of Modesto was the contractor.

Collier-Unruh Act

Added Funds Are Provided For Local Roads, Streets

By C. T. LEDDEN, City and County Projects Engineer

Editor's note: This analysis of S.B. 344 and description of the administrative procedures involved was presented at the street and highway conference in Berkeley on January 31, 1964.

Senate Bill 344 was the parent legislation which resulted in the "Collier-Unruh Local Transportation Development Act" added to the California statutes during the 1963 legislative session. The following is a discussion of the act itself with particular emphasis on its administration and the procedural policies which have been developed for its implementation.

Basically, the Collier-Unruh Act is a tax measure sponsored by the cities and the counties of California to provide additional funds for improvement of city and county transportation systems.

The act embodies two major provisions: one relates to the financing of public rapid transit; the other pertains to the financing and improvement of city streets and county roads.

Provisions which refer to rapid transit are contained in the two following provisions:

(1) The board of supervisors of each county is authorized to pass an ordinance increasing the present fee on motor vehicles (in-lieu tax) by one-half of 1 percent—this increase to be used exclusively for planning, acquiring, constructing, operating and/or maintaining a rapid transit system. It may also be used for making contributions to another district or agency duly constituted for this purpose.

(2) Any city or county is authorized to spend for the same purposes described above the moneys which it presently receives from existing motor vehicle (in-lieu tax) fees.

These provisions of the act which refer to rapid transit are the responsibility of, and will be administered by the Department of Motor Vehicles.

Remaining Provisions

The remaining provisions of the act which pertain to the financing and improvement of city streets and county roads will for the most part be administered by the Department of Public Works through the Division of Highways.

To assist in this administration the department has prepared and distributed a "Procedural Manual" to guide the cities and the counties as well as the division's staff in implementing the various provisions and requirements. It should be emphasized that these administrative procedures have resulted from cooperative effort by representative committees appointed by the League of California Cities, the California Association of County Supervisors, and the State. They represent, in fact, a compromise position. They are, however, workable and are mutually acceptable as a starting base with the added understanding that they are subject to modification where necessary for clarification or to effect a better statewide program.

As to the new street and road provisions of the act, it is estimated that for the 1964–65 fiscal year approximately $74,800,000 in additional funds will be made available to the cities and counties for street and road purposes. This additional revenue will be derived from a 1-cent increase in gasoline tax, a 1-cent increase in liquefied petroleum fees and 19 percent across-the-board increase in commercial weight fees. About 71.1 percent of this increase or $53,300,000 will be apportioned to cities; the remainder of 28.9 percent or about $21,500,000, will go to counties. All apportionments will be in accordance with statutory formulas.

Road Programs Affected

Three existing street and/or road programs are affected by the act, and one new street and road program is created by the act. Two of the existing programs involve cities only; one involves counties only. The new program involves both cities and counties.

The old ⅛-cent gas tax program available to cities for construction of major city streets and general street maintenance has been increased by 0.1 cent; this now becomes a 7¼-mill or 0.725-cent program. The act changes the percentages of these funds which can be spent for construction and maintenance; at least 40 percent must now be expended for construction, and a maximum of 60 percent may be spent for maintenance. The construction must be on a select system of streets; the maintenance may involve any street within the city.

The 0.1-cent increment which became effective with the November (1963) apportionment is estimated to amount to approximately $6,600,000 in the 1964–65 fiscal year, increasing the cities' allocation under this program for this period to an estimated $47,205,060. This program will be administered by the department generally under the same statutes which covered the old ⅛-cent program. The only change in administrative procedures under this program is that projects may henceforth be given a field review by the department during construction.

The second program involving cities only which is affected by the act is that which provides gas tax funds for engineering or adimnistrative purposes. This program is continued—the only change being that accumulated funds which are three years or older, if converted by a city to use for construction, must be spent on the select system of streets instead of on the old major street system. Administration of this program will continue as the responsibility of the department.

For Counties Only

The third existing program affected by the act pertains to counties only.

Looking north along Santa Anita Avenue in the City of Arcadia, at the intersection of Camino Real Avenue. This is the type of local improvement which will be accelerated under the Collier-Unruh Act.

Previously, the counties received under various statutes the equivalent of the revenue from 1⅜ cents of gas tax, amounting to approximately $81,000,000 in the 1962–63 fiscal year. They also renewed an additional amount which varied from year to year according to vehicle registrations. In the 1962–63 fiscal year this additional amount approximated $14,000,000, bringing the total to approximately $95,000,000.

Under provisions of the act, the statutes are simplified to the extent that effective January 1, 1964, the counties will receive apportionments equivalent to the revenue from 1⅝ cents gas tax. Under the new simplified formula some counties will receive more and some will receive less than they did previously; statewide, however, overall apportionments under the new formula are estimated to be somewhat greater.

Old System Abolished

The old county primary road systems are abolished in favor of a select system of roads, and the act stipulates that at least 20 percent of the new 1⅝-cent funds must be spent for construction on right-of-way on this select system. The portion of the program involving these 20-percent funds will be administered by the department to the extent of verifying that the required expenditures are

ade in accordance with directives of e act. The remaining portion of this ogram will continue to be admin- ered by the office of the State Con- oller as in the past.

The new program created by the t, and which involves both cities d counties, is often referred to as e 1-cent program. Actually the act ovides that the revenue from 1.04 nts of gas tax shall be made available the local agencies beginning Janu- y 1, 1964. It is estimated that this w revenue will amount to about 7,715,000 during the 1964–65 fiscal ar. These funds will be allocated nually by the California Highway ommission and apportioned and paid onthly by the department.

Apportionments and payments will made to eligible cities and counties accordance with statutory direc- es. First of all, each eligible city ill be entitled to a monthly grant of 00 and each eligible county a onthly grant of $800. The remainder each monthly allocation will then divided among the various counties the basis of relative vehicle regis- ations. The amounts thus computed ill constitute the "base sum" for ch county. Each county's "base m" is then divided between incor- orated and unincorporated areas on e basis of assessed valuations. The ncorporated" areas' share is then di- ded between the cities making up at area on the basis of relative opulations.

Eligibility

To become eligible for apportion- ents, each city and county must by fficial action adopt a resolution stat- g that it approves of the imposition the additional gas tax and desires to rticipate in the resulting street and ad improvement program. A copy such resolution must, also, be filed ith the department.

The act recognizes that the desig- ated three-way formula for appor- onment of funds may not in every stance adequately meet the local eeds, particularly with respect to dis- ibution within a county according relative assessed valuation. To per- it adjustments in this portion of the rmula, the act authorizes local agree- ents between a county and any of its cities for purposes of effecting a different basis for distribution of the county's "base sum" allocation. The department is required to verify such agreements prior to making the adjusted apportionments.

The funds thus received by each city and county must be expended for construction or acquisition of rights-of-way on a select system of streets and roads. Such expenditures must be used primarily for benefiting vehicular traffic on that select system; they must also be made in accordance with designated geometric and structural standards—the same standards used in preparation of the local street and road deficiency studies made for the Legislature in 1959 pursuant to Senate Concurrent Resolution No. 62. For sufficient cause the department is authorized to permit deviations from these standards.

Intended to Supplement

The select system of streets and roads upon which the funds are to be expended is, generally speaking, intended to supplement, from a traffic standpoint, the state highway system. A mileage limitation is established for each city and county select system equal to 50 percent of the total public highway transportation system, less the mileage of state highways. Selection of each local system is the responsibility of the individual city or county. This selection is guided by designated criteria and is subject to review and approval or modification by the Highway Commission. For purposes of permitting the expenditure of 1.04 cents or "matching" funds on cooperative projects on state highways, the act provides for their inclusion in the select system.

In order to provide local participation in the program the act requires "matching" expenditures by each city and county. This "matching" is on an annual basis, rather than a project by project basis, except that an opportunity is provided to accumulate "matching" credit for 10 years ahead. The "matching" funds must derive from sources other than the Highway Users Tax Fund or the State Highway Fund and they must be expended on the same select system and in accordance with the same standards as the gas tax funds. The designated matching ratio which reaches a 1:1 basis after seven years starts with a 1:2 basis ("1"—local agency funds, and "2"—gas tax funds) for the initial four-year period.

Matching Credit

To permit the use by a city or county of certain local contributions for "matching" credit the act provides that expenditures by a subdivider, under the direction of a city or county, for construction or right of way acquisition on the select system shall be considered as expenditures made by that city or county.

The act provides that a report shall be submitted annually to the Legislature by the department covering expenditures by the local agencies on the select system. Fiscal information for this report is to be prepared by the cities and counties and forwarded to the department in two separate reports: one to be submitted by July 15 each year covering expenditures of "matching" funds, and the other to be submitted by September 1 each year covering detailed expenditures, in general. Information for the report covering actual construction of the select system roads and streets is to be obtained by the department by review and inspection of work in progress, or by audit and inspection of the work following completion.

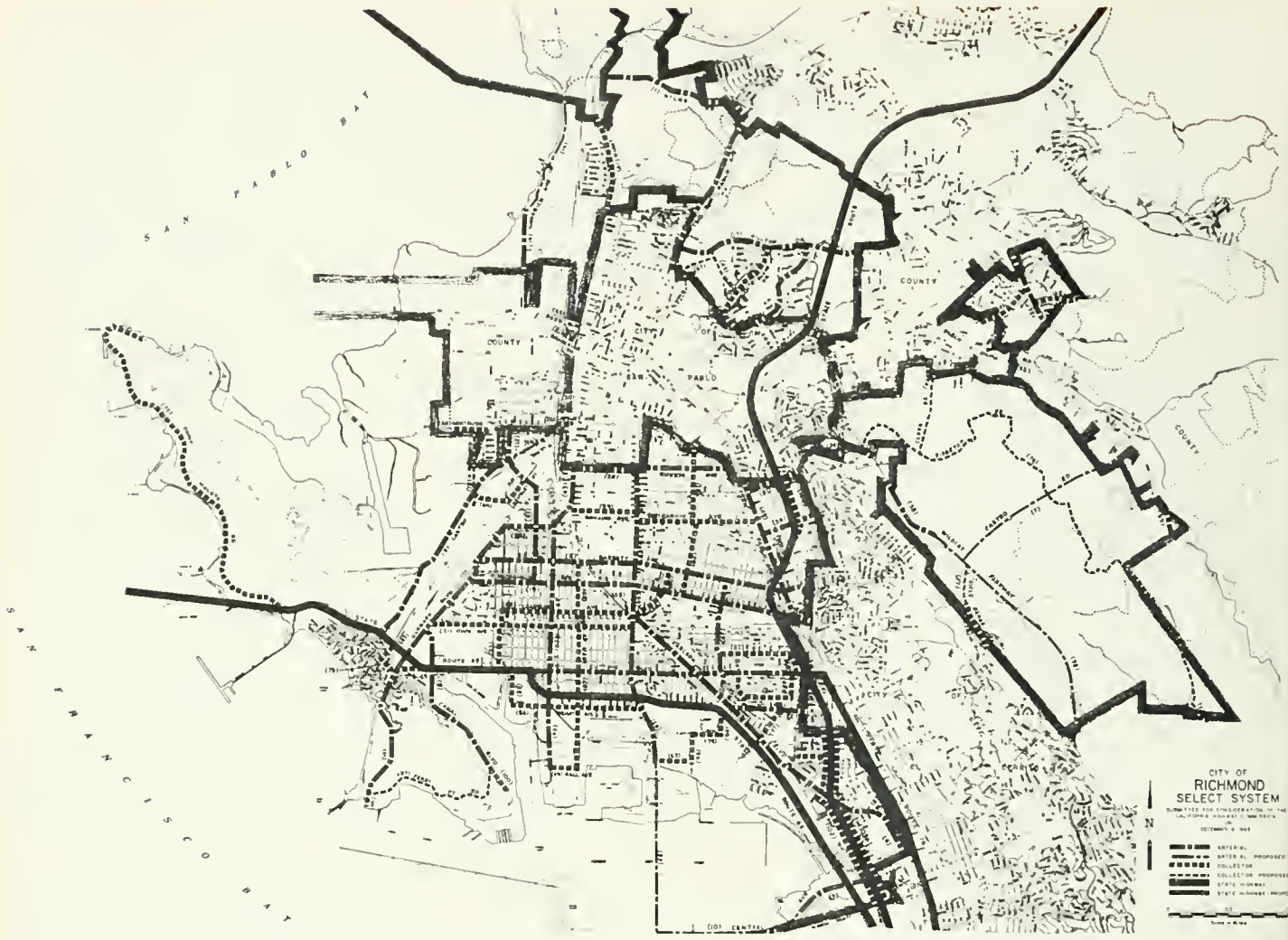
Penalties Listed

To assure compliance of the new street and road improvement program with requirements, the act provides that for any one of four causes a city or county must forfeit by way of penalty the apportionments or portions thereof to which it would otherwise be eligible. These causes are:

(1) Failure to submit the original resolution concurring in the imposition of the additional gas tax and expressing a desire to participate therein.

(2) Failure to expend the allotted 1.04-cent gas tax funds within a specified (five-year maximum) period.

(3) Failure to expend sufficient "matching" funds in any fiscal year when "matching" credit has not previously been established.



A typical map showing the new select system of roads and streets, this one for the City of Richmond.

(4) Failure to construct an improvement project in accordance with designated standards or approved deviations therefrom.

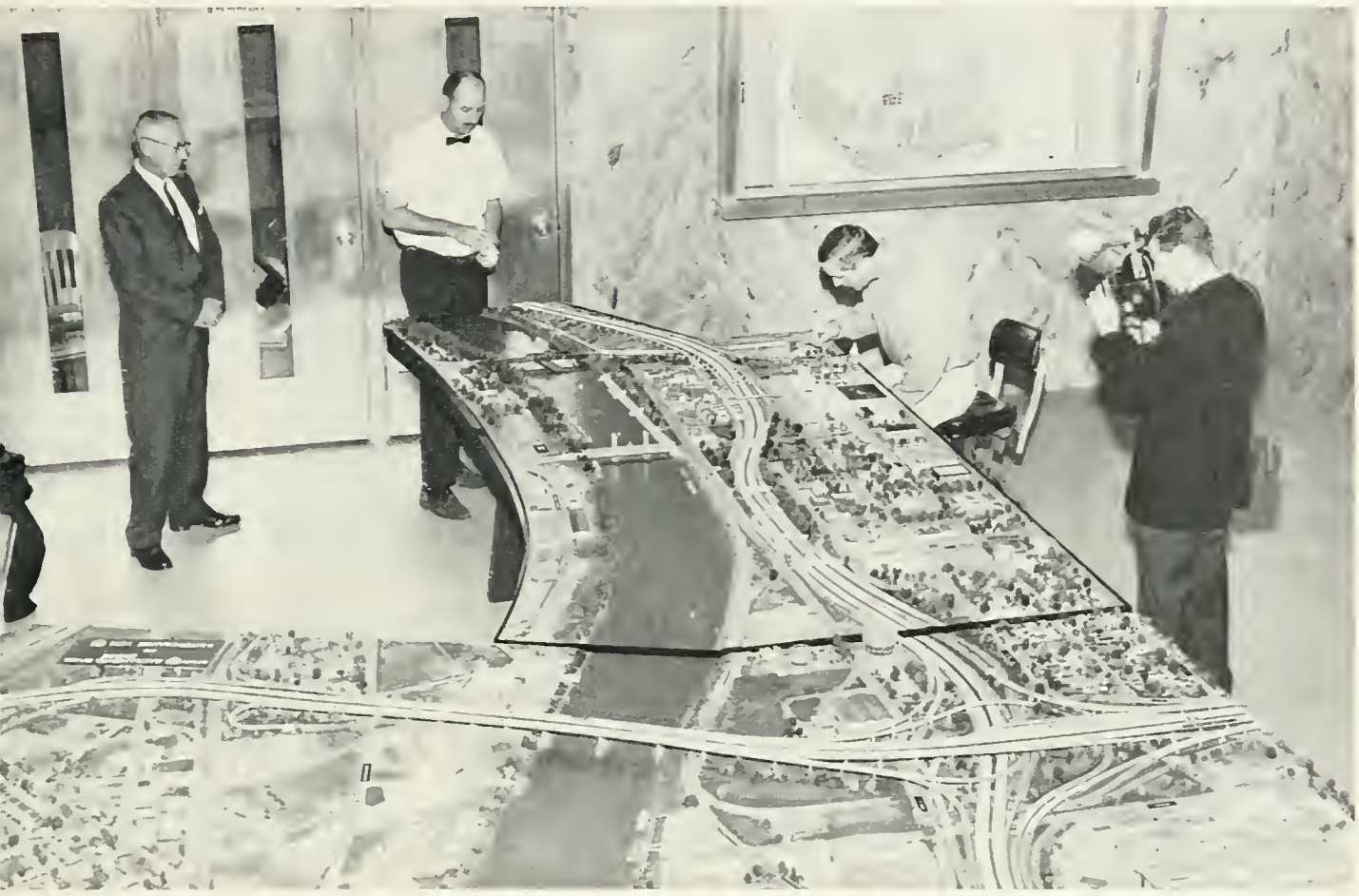
Funds withheld from future apportionments by the department for causes (1), (2), and (3), above are automatically redistributed to the other cities and counties. Funds withheld for reason (4) are held in suspense by the department pending correction of the deficiency by the city or county. If this correction is not made within a specified period (four-year maximum) the funds are reapportioned to the other cities and counties.

Administratively, the most important responsibility given to the department under terms of the act involves verification of compliance of expenditures under the act with the numerous provisions of the act, and the possible withholding of funds from future apportionments for noncompliance.

The act does not require a city or county to submit any program, nor any plans or specifications. In order to facilitate administration, however, the department is requesting that each local agency where possible submit annually a brief outline of its proposed work schedule, a set of plans and estimate of quantities if available when a project is advertised, and a notice of when a project is started and when it is completed. It is felt by the department that compliance with this request will result in greater benefits to a city or county than any inconvenience that may be caused. Also, while not required by the act, in order to be of maximum assistance to the cities and counties, and in an effort to minimize possible nonconformance of projects with designated standards and criteria, the department will be available to give prior review and comment regarding any plans when so requested by a city or county.

In summary, it can be said that the act specifies three distinct levels of responsibility: one by the California Highway Commission, one by the Department of Public Works, and one by the local city and county governments. Further, the act enumerates four separate conditions under which a city or county must forfeit by way of penalty the apportionments or portions thereof to which it would otherwise be eligible. As a cooperative undertaking by governments of the State, it should be incumbent on all three levels of responsibility to see that the necessity for penalty forfeitures does not arise and to strive together to make this a successful as well as a workable gas tax program.

Sacramento Freeways Model Exhibited in Capitol



vo large three-dimensional models of a portion of the freeway complex planned for Sacramento went on display in January in the east wing lobby of the ate Capitol. The models, prepared by the Bridge Department's architectural section, had been on display separately in various locations, and were joined gether for the Capitol exhibit. The Sacramento River is shown in the center, with the Interstate 80 freeway bridge (now under construction) in the foreground, it will appear by 1967. The north-south freeway paralleling the river is Interstate 5. It swings away from the river just north of the Tower Bridge to fit in ith the Sacramento Redevelopment area and historic landmark plans. Shown putting finishing touches on the model before the clear plastic cover was fitted ver it are Louis Baker (standing) and William H. Tuthill (seated) of the bridge architectural section. At left is Assistant District Engineer H. F. Sherwood of istrict III, and at right is a Sacramento television cameraman recording the installation of the display. The exhibit remained in the Capitol until early in March and was then moved to location in downtown Sacramento.

ontinued from page 52 . . .

The AC Transit System has cut me schedules of their transbay buses nd have attributed the time savings o the completion of improvements on ne bridge.

Reconstruction of the bridge has so provided the additional capacity o handle increased traffic which has een developing during the interven- ng years. In November of 1963, a ew high of 145,046 vehicles crossed ne bridge without incident in a single 4-hour period. The average daily affic for the calendar year 1963 was 19,506 vehicles. In 1958, the year re- onstruction was started, the volume as 99,295.

N. C. Raab, projects engineer, was in overall charge of reconstruction of the San Francisco–Oakland Bay Bridge from the inception of the project in 1957 until his retirement in July 1963. Construction was supervised by Ben Balala, principal bridge engineer, and his assistant, Howard C. Whitty. Design was accomplished under the direction of Howard F. Topping and Vernon J. Richey.

There still remains some mechanical and electrical work to be done, including the installation of additional call boxes to increase the ease with which motorists can call for assistance when in difficulty. The lower deck is to be resurfaced under a contract which will be started this spring, and new equipment to help maintenance forces will be installed. These contracts along with some minor items, will finally complete the rehabilitation of the Bay Bridge. However, the major goal has been reached—that of transforming the structure to unidirectional traffic.

The Department of Public Works has awarded a $1,739,000 contract for constructing 1.2 miles of six-lane freeway on State Sign Route 22 (Garden Grove Freeway) between Harbor Boulevard and Garden Grove Boulevard in Orange County.

Critical Path Method

By RICHARD V. POTTER, Systems Research Engineer

In December of 1962 a two-day management conference was held in Sacramento for division personnel of principal grade and up, covering a review of electronic data processing methods and procedures. At this session two hours were devoted to an explanation of critical path method and the application of this scheduling technique to various phases of highway work. For a few present this was the second introduction to CPM, the first having been at a regional conference on improved highway engineering productivity held in San Francisco in March of 1962 under auspices of the U.S. Bureau of Public Roads.

A workshop photo, showing the instructors, R. C. Tennent (left) and L. R. Shureman (right) of the Bureau of Public Roads.

Elements Demonstrated

The Sacramento discussion of CPM was basic. Elements of the process, nomenclature, explanation of terms, arrow diagraming and computer applications were demonstrated by a representative of the Sacramento office of the IBM Corporation. This introduction was followed by a projector exhibit and step-by-step explanation of a CPM network for a hypothetical single-span bridge construction project (Figure 1). The network of diagramed construction operations illustrated how restraints of time throughout the project could be visually appraised and decision-making helped in the economical assignment of men and equipment on the simulated bridge construction project.

The CPM network and material used for this explanation were taken from an article by L. R. Schureman of the U.S. Bureau of Public Roads in the April 1962 issue of *American Highways* magazine. This acknowledgement is mentioned to point up the then existing situation that although several articles depicting the use of CPM in the building industry and in missile production had appeared, very few articles relating critical path procedures to highway operations or couched in terminology readily understandable by highway people had been published.

The Sacramento management conference discussion concluded with a display and explanation by Raymond K. Sweet, program and budgets engineer, District VII, of model or typical CPM networks applicable to highway planning and design work which were then under study in the district.

Interest Stimulated

This indoctrination to the multiple uses of CPM in highway work stimulated interest in the subject in the division and led to a decision to arrange for training on the subject for selected personnel from district and Headquarters units.

In October 1963, the division was fortunate in obtaining L. R. Schureman and R. C. Tennent of the Bureau of Public Roads to conduct a two-day workshop seminar in Sacramento covering basic principles of CPM technique and its application to highway work. The Bureau of Public Roads was at the time undertaking a comprehensive study of CPM as it relates to diversified functions of highway work. It subsequently has sponsored publication of an illustrated procedural manual for applying the critical path method to highway department engineering and administrative functions. Copies of this manual have been requested for distribution in the division.

A staff engineer in Headquarters Design, Ebert Jung, was designated in 1963 for liaison on the subject of CPM with the districts and coordination of CPM applications in various functional areas of highway effort. At this writing a moderate backlog of CPM networks has been obtained together with explanatory material. The networks and related information are available to the districts upon request.

Varied Experience

Experience of the districts in application of CPM technique is varied and a few instances are mentioned.

Using the planning program as a basis, District I has developed a production control chart for all projects, extending these data to the year 1967. Control dates related to all major preconstruction activities between inception and advertising, for each project, are then transferred to a master critical path diagram. The district coordinator furnishes department heads with copies of this diagram and reschedules functional activities where conflicts in planning or work overloads occur.

For greater detail at the project ngineer level, District I uses an ad- ance planning critical path network nd a design department critical path iagram.

District III has networked three de- gn projects on interstate and federal id routes, two having about 100 ac- vities and the third having 240 activi- es. Time data from these networks ere listed on input forms furnished y Headquarters and computer print- uts obtained tabulating the activities hich fell on the critical path. The istrict found the data valuable in heduling manpower and predicting eas susceptible of delay. In each in- ance the so-called LESS program least-cost estimating and scheduling) as used to computerize the network ata. The PERT program (program valuation review technique) has also een taped in the division's data proc- sing center and is available for use producing tabulations based on ilizing the "pessimistic", "average" id "optimistic" time factors prede- rmined for the activities.

Advantages Summarized

District IV recognized that net- orking the contractor's job opera- ons would provide means for the de- gn project engineer to become more nowledgeable about the sequence of onstruction operations from the con- actor's point of view and concur- ntly furnish a way to confirm the timate for number of working days a contract furnished in the prelimi- ry report. Advantages of contract me analysis by CPM have been sum- arized by District IV as follows:

Staff engineers work out a CPM exercise at the workshop session.

1. Factors such as utility relocation controls, traffic handling, stage construction, ordering and fabricating time allowances, settlement periods, specified order of work, practical sequence of construction operations, etc. can better be analyzed with respect to their effect on overall construction time requirements.

2. A comprehensive, clear, visual diagram of the entire job is provided. The Construction Department and Headquarters can better determine exactly what the designer considered in arriving at the recommended time limit.

3. Controlling items can be clearly recognized and identified, allowing the consideration of the effect of changes or modifications toward either lengthening or shortening the overall time as the individual case requires.

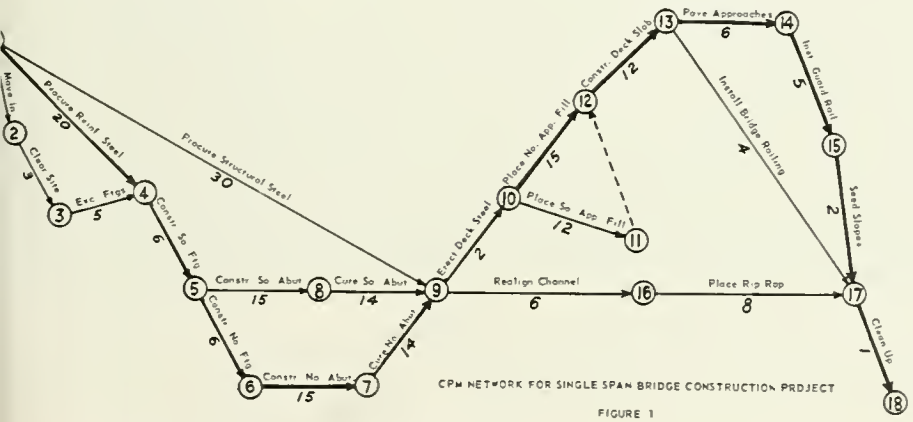
4. Network preparation encourages the designer to think logically and systematically, thereby eliminating many possible oversights and omissions.

5. The method has the capability of allowing computer application if the project variables and controls are complex.

The district's instructions require that, in addition to including in the preliminary report the usual bar chart (Form R-147) for estimate of construction time, a CPM network analysis of the construction operations also be prepared and submitted in the preliminary report for corroboration of the estimated number of working days.

Departmental Training

Departmental training on CPM in District IV is handled by the district's programs and budgets department with the greatest activity so far being in application of the technique to preconstruction work. Network analyses have been used in 22 design projects to arrive at more realistic plan completion dates and to better insure meeting significant intermediate dates. The PERT and LESS computer programs have been used in some of these projects. The district observes that better project coordination has resulted as intermediate dates involving service departments are determined ahead of time and these departments are then in a position to evaluate their work loads and prepare themselves to meet the required target dates.



ure 1. Sample CPM network for single-span bridge construction project. Heavy line illustrates the critical path.

District IV considers that the project engineer is the key man in preparing a CPM analysis on a particular project. Since such an analysis requires a wide knowledge of procedures and activities to complete a project in design, every department in District IV has prepared a flow diagram of its activities and operations involved for a hypothetical large Interstate freeway project. These departmental diagrams materially aid the project engineer in the preparation of the CPM network.

Further Studies

In addition to its pioneer work in developing CPM networks for use by project planning and design engineers, District VII is currently studying means to schedule the district's entire planning program on a CPM network to the degree that progress of the principal functional stages of each project in the overall program can be monitored.

In the processing of contracts the division does not include in the special provisions any requirement for submission of critical path networks by bidders. In this area, however, contractors on highway construction in California have voluntarily programed their operations on the basis of CPM and other public agencies in the State such as the U.S. Corps of Engineers and the Department of Water Resources have advertised work specifying submission of CPM networks by successful bidders.

Critical path networking can alert management to areas where program conflicts exist. Overload departmental situations can be detected and a visual means furnished for adjustment with a probability of success. The technique provides an excellent means of scheduling manpower by names and dates, reporting progress and communicating status of work to supervisors and subordinates. The disciplined thinking required for scheduling a complex project from inception to final completion results in orderly planning and job coordination.

The scheduling of highway work in the planning, design, right-of-way, construction and maintenance phases of the division's work by critical path technique is optional. It is the prerogative of each district or divisional unit to develop networks applicable to its methods of project development, taking into consideration the talent available in the district for network development, the cost and the practical benefits to be derived from the scheduling undertaken.

Scenic Highway Advisory Committee Holds Meeting

The Governor's newly appointed Scenic Highway Advisory Committee met in Sacramento on February 19. Those attending were (seated around table beginning left): Edwin S. Moore, member, executive vice president of the California State Automobile Association; Robert Grunwald, member, landscape architect from Hanford and currently president of the California Chapter of the American Institute of Planners; Dee W. McKenzie, member, Chief of the Design Section, Highway and Bridge Division of Sacramento County; Senator Fred S. Farr of Monterey County, sponsor of the legislation creating the committee; John Erreca, State Director of Public Works; Harry P. Schmidt, committee chairman, County Supervisor of Merced County from Gustine; Richard M. Leonard, member, an attorney from Berkeley; Nathaniel Owings, committee vice chairman, partner in a San Francisco architectural firm whose home is in Big Sur; and C. Perry Walker, member, an engineer now also serving as city councilman of Manhattan Beach and who is past president of the League of California Cities. Seated against the map in right background between Leonard and Owings is Lawrence E. Larsen, assistant design engineer for the State Division of Highways.

TTE Meeting

Street, Highway Conference Stresses 'Broader Picture'

Many of the nearly 500 street, road, ghway and traffic experts of city, unty, state and federal government no attended the 16th annual street d highway conference sponsored by e Institute of Transportation and affic Engineering at the University California, Berkeley, January 30–bruary 1, remarked that several of e speeches reflected great changes in lifornia's highway picture.

"I never thought the head of the reau of Public Roads (Rex M. hitton, Federal Highway Admin-rator) would fly to California to tell that increased costs can be justified locating and designing highways to prove their appearance," one said, r that the Chairman of the Senate ansportation Committee (Senator ndolph Collier) would devote half his speech to airport development." ven though Senate Bill 344, which dden (Charles T. Ledden, City and unty Projects Engineer, California vision of Highways) explained to us, will increase our workload," a county road commissioner added, "it will go a long way toward making our streets, roads and highways a smoothly integrated system."

Whitton Urges Aesthetics

Whitton appeared as the first speaker after the welcoming address by Dean George Maslach of the University's College of Engineering. Urging increased attention to aesthetics, Whitton said that highway engineers in the past may have underestimated its desirability or overestimated its possible added costs. He praised the increasing tendency toward enlisting landscape architects and city planners to assist in highway location and design.

"Note that I include location as well as design," Whitton said "Aesthetics must be an important consideration from the beginning; it is not a trimming to be tacked on after the location is settled and the design details are half done."

The Federal Highway Administrator pointed to the 41,000-mile interstate highway system, 80 percent of which is on new location, as causing the greatest single impetus to the blending of aesthetics and engineering.

He suggested that engineers inventory scenic points of interest which might affect route location and take advantage of any breathtaking vistas for locating safety-rest areas.

Later in the program, Harry D. Freeman, Deputy Director for Planning, California Department of Public Works, told attendees that the Legislature gave serious and sympathetic attention to the conservation of natural scenery and the need for aesthetics and recreation at its last session.

Freeman used color slides to illustrate views of the scenic corridors along the routes of the "master planned" scenic highway system provided by Senate Bill 1467, and outlined steps that must be taken by local governmental bodies to protect them.

section of Sir Francis Drake Boulevard (Federal Aid Secondary County Road 608) in Marin County northwest of San Rafael illustrates the point made by the speakers at the recent Street and Highway Conference that highways should be aesthetically pleasing as well as functional.

Tribute to Collier

The Chairman of the Assembly Committee on Transportation and Commerce, Tom Carrell, preceded Senator Collier on the program, and paid tribute to him as the man nationally known as "Mr. California Highways," and to "a forward-looking Highway Commission."

Part of California's success in new and better highway facilities, he indicated, "has been accomplished largely through the recruitment of the nation's finest group of planners, designers, engineers, land acquisition experts and technical personnel."

He added, "California's highway problems are unique by reason of the State's size, population growth rate, and the great extent to which we have become a people dependent upon automotive transportation."

Assemblyman Carrell referred to two measures introduced by him in the 1963 General Session of the Legislature to relieve traffic congestion and promote safety. One provided for the channeling of slow-moving traffic into the right-hand lanes of multiple-lane highways. The other provided for increasing the maximum speed limit on certain freeway stretches to 70 miles per hour where, in the opinion of both the Division of Highways and the Highway Patrol, it is safe to do so.

Senator Collier had addressed last year's streets and highways conference in Los Angeles on the need for support for legislation he had sponsored for obtaining financing for proposed select systems of city streets and county roads.

He told the delegates at this session that, "Obviously, all of you did your homework, and, when the chips were down, Senate Bill 344 went through both houses with exceptionally strong votes and provided about $70,000,000 annually for city streets and county roads."

Senator Reviews Legislation

The Senator reviewed the legislative intent of the 1947 Collier-Burns Act and subsequent laws aimed at the efficient administration of State provided funds.

"The Legislature has an interest in local streets and roads because of their fundamental importance in the overall highway system. The Legislature also has an obligation to insure that local road departments are operated efficiently, because it is the Legislature that imposed the taxes to finance the road program."

Referring to the increased attention to highway aesthetics, he said, "We must attempt to direct the efforts for these facilities (programs for scenic highways, roadside safety rests, elimination of billboards, etc.) so that a reasonable amount of money is allocated to these 'nonproducing functions,' and also to see that the maximum aesthetic value is received for each dollar so allocated."

Senator Collier devoted the last half of his talk to legislative studies in progress to protect and preserve existing airports from encroachment and to finance improvements in facilities for general aviation.

Division of Highways City and County Projects Engineer Charles T. Ledden discussed the procedural policies which have been developed for the implementation of Senate Bill 344 as it relates to the financing and improvement of county roads and city streets.

These administrative procedures, he emphasized, resulted from cooperative effort by representative committees appointed by the League of California Cities, the County Supervisors Association of California, and the State.

Select System Explained

"The select system of streets and roads upon which the funds are to be expended, generally speaking, is intended to supplement, from a traffic standpoint, the state highway system," Ledden said.

He advised city and county delegates of the four ways in which apportionments may be forfeited (see article, "Collier-Unruh Act," page 55) and promised that the staff of the Division of Highways is available when requested by cities and counties to review plans to minimize possible nonconformance of projects with designated standards.

Charles G. Beer, urban planning engineer, Division of Highways, outlined the requirements of the Federal Aid Highway Act of 1962 for projects in urban areas of more than 50,000 population to be eligible for federal funds after July 1, 1965.

All such projects, he said, must be based on a continuing comprehensive transportation planning process carried on cooperatively by the State and local communities.

The eighth metropolitan areas affected by this legislation are those covered by the Los Angeles Regional Transportation and San Francisco Bay Area Transportation studies, and the San Diego, Sacramento, Fresno, Bakersfield, Stockton and Santa Barbara areas.

"The Division of Highways is seeking the active support of local governments in these metropolitan areas," Beer said, "to make certain that the benefits of the federal aid highway funds are not lost to the State."

Beer declared the act's provisions reflected the impatience of the American people with piecemeal transportation planning.

Pointing out that the federal government requires a formal procedure, supported by a written memorandum of understanding or agreement between the State and the governing bodies of local communities, he added, "the basic agreement is a matter of high priority, and to provide for the necessary reviews, we believe it should be executed by July 1, 1964. This will allow one year in which to secure any modifications considered necessary and any supplemental agreements on essential subject matter areas."

Other Speakers

Other speakers at the conference's general sessions included Leland J. Deverman, office of the State Controller, who spoke on the new uniform budget and road accounting procedures, and Lee N. Glaeser, Controller, Santa Clara County, who commented on Deverman's remarks; Robert C. Lynch, Deputy County Counsel, Los Angeles County, who explained recent developments in public liability; and Arnold Olitt, Vice President, Woodward, Clyde, Sherard and Associates, Oakland, who discussed the structural design of roads and streets.

Harmer E. Davis, director, Institute of Transportation and Traffic Engineering, made several predictions

concerning future transportation patterns and closed the conference.

The luncheon meeting at the Claremont Hotel, Berkeley, on the final day was addressed by R. H. Minor and Arthur Leinwohl of the management systems, Lockheed Missiles and Space Company, Sunnyvale, who analyzed the effect of the national population explosion on the supply of raw materials and the future role of transportation.

Following the morning general meetings, delegates attended workshop sessions on the opening day of the conference on right-of-way problems, the geometric design of roads and streets, street and highway maintenance, planning for moving traffic, guardrails and median barriers, avoiding legal liabilities in public works, construction job controls and changed conditions, and planning for parking.

Other Subjects Discussed

The second day's workshops considered soil stabilization and drainage, problems of mass rapid transit, purchasing specifications, getting the most out of limited right-of-way, the use of continuous left-turn lanes, the critical path method for preconstruction scheduling, engineering and construction procedures for San Diego streets, maintenance agreements between state and local agencies, and traffic safety techniques and equipment.

Richard F. Lovejoy, City of Richmond Director of Public Works; A. C. Keith, Road Commissioner, Riverside County; and J. P. Sinclair, Assistant State Highway Engineer, District IV, San Francisco, were chairmen and vice chairman, respectively. Robert E. Cron, Jr., of the Institute of Transportation and Traffic Engineering, served as general secretary, and Wayne H. Snowden, also of the Institute, was in charge of publications.

A $5,868,000 contract was awarded by the Department of Public Works on April 6 for grading and paving 4.5 miles of freeway on U.S. 299 between Mad River and Blue Lake in Humboldt County and grading an additional mile north of Blue Lake for future freeway.

'Tempus Fugit' Corner

The following items appeared 25 years ago in *California Highways and Public Works*.

New Sepulveda Link Opened

The formal acceptance by the State on November 30, 1938, of the 3.66-mile paving contract connecting San Fernando Road, just northerly of San Fernando, with Brand Boulevard, marked the opening to through traffic of a direct route (via Sepulveda Boulevard) between the Ridge Route Alternate and the Los Angeles Harbor and West Coast beach cities, including the communities of Santa Monica, Ocean Park, Venice, El Segundo, Manhattan Beach, Hermosa Beach, Redondo Beach, Long Beach, and points southerly.

Traffic from the San Joaquin Valley formerly was required to pass through downtown Los Angeles or the congested Hollywood district in order to reach the harbor or West Los Angeles and the beach cities.

Federal requirements in connection with grading this section provided that grading work be done by hand labor methods. About 350,000 cubic yards of roadway excavation were removed in this manner at a cost of $488,613.72. The project afforded employment amounting to 486,316 man-hours of labor.

Mountain Springs Grade Problems

Since construction was started in October on the upper portion of the Mountain Springs Grade, the contractor has made very good progress on this difficult piece of highway construction, according to E. E. Wallace, district engineer.

In the development of both railway and highway transportation between the agricultural areas of the Imperial Valley, southwestern Arizona and San Diego's favorable shipping and harbor facilities, the mountain range along the San Diego–Imperial county border has always been the major barrier.

The contract item of roadway excavation involves the movement of approximately 100,000 cubic yards per mile. The excavation consists, for the most part, of granite rock, and in consolidating this rock into the embankment sections it is proposed to use 13,000,000 gallons of water. This large amount of water will be used to flush the fine material down through the voids in the rock, and thus consolidate the embankments to prevent future settlement. The contractor has installed a water line, and is pumping water from Jacumba, 5½ miles westerly from the project.

The roadway section must be constructed through a section of high, steep, rocky slopes, and in order to retain the embankment, and to prevent the fill material from spilling far down these slopes, metal cribbing is to be installed. . . . The new roadway will be 36 feet wide.

The Mountain Springs Grade section of U.S. Highway 80 has gradually developed from an old wagon stage road, rising from the desert below sea level to the summit of the Coast Range. It extends from El Centro, 11 feet below sea level, to an elevation of 3,240 feet at the summit near the county line.

Western State Highway Officials Meet

The annual meeting of the Western Association of State Highway Officials was held at San Francisco March 6, 1938. The meeting was purposely scheduled at that time so that it might run concurrently with the national convention of the American Road Builders' Association and the national convention of the Associated General Contractors.

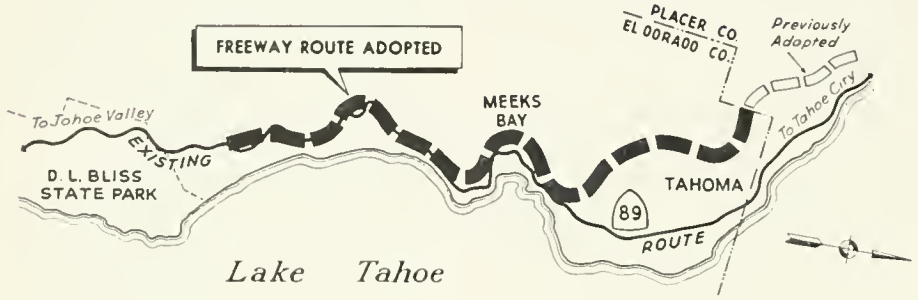
At the opening session the delegates were welcomed by C. H. Purcell, State Highway Engineer, representing Director of Public Works Frank W. Clark.

On Thursday morning the meeting was devoted to a discussion of soil studies led by T. E. Stanton, Materials and Research Engineer of the California Division of Highways.

A $2,595,000 contract has been awarded by the Department of Public Works for constructing four miles of four-lane freeway on U.S. 101 between North Main Street in Salinas and Espinosa Road in Monterey County.

New Routes

Another 30 Miles of Freeways Are Adopted



The California Highway Commission adopted nearly 30 miles of freeway routings on three existing and one planned route in the year's first two months, including a 4.6-mile stretch in San Francisco and San Mateo Counties and a six-mile scenic parkway type routing in the Meeks Bay area of Lake Tahoe in El Dorado County.

The other freeway routings were in San Joaquin, Calaveras, and Trinity Counties.

Additionally, the commission adopted a 2.9-mile improved routing of State Sign Route 36 in Humboldt County, a conventional highway.

Hunters Point Freeway

The San Francisco–San Mateo routing was for what is known locally as the Hunters Point Freeway between a connection with the Bayshore Freeway (US 101) in Brisbane, three-fifths mile south of the San Francisco county line, and the junction of the future extensions of the Embarcadero and Southern freeways near Evans Avenue in San Francisco.

The commission conducted a public hearing on the matter on December 11, 1963.

The adopted route, the "D-C" line discussed at earlier hearings held by the Division of Highways, crosses the tidelands area in a northeasterly direction to east of Candlestick Park, continues on a northerly alignment across the western portion of South Basin, then extends north and east of the P.G. & E.'s station into India Basin before turning northwesterly to the northern project limit.

Noting that the adopted routing is longer, more costly, and will have fewer user benefits than the one recommended by the State Highway Engineer, the commission said its choice was based on the superior overall effect of the adopted route on the social, economic and general welfare of the community.

The adopted route was favored by arious local authorities and commuity organizations.

Supervisors Endorse Route

The adopted route in El Dorado County was endorsed by the county oard of supervisors and recomended by the State Highway Engieer. It generally follows the existing lignment of State Sign Route 89 from ne-half mile north of the D. L. Bliss tate Park to the El Dorado–Placer ounty line where it will connect with freeway routing to the north dopted by the commission in March 963.

State Highway Engineer J. C. Womack said that the scenic parkway-ype facility will have a screen of atural vegetation between the highay and adjacent homes and will take dvantage of the scenic corridors off he freeway's right-of-way.

The new, freeway routing for 14.7 iles of State Sign Route 8 runs genrally north of and parallel to the exting highway, eliminating sharp urves and dips, between the Calaveras iver near Bellota in San Joaquin ounty and State Sign Route 12 near alley Springs in Calaveras County.

Scenic Highway Route

Weaverville–Scott Mountain Road Federal Aid Secondary County Road 089) in Trinity County, a route beween U.S. 299 at Weaverville and .S. 99 at Yreka, was included in the ate scenic highway system enacted y the Legislature in 1963. It will be nown as State Route 3.

The adopted freeway routing genally will traverse the eastern portion f the Trinity River Valley between offee Creek and Ramshorn Road, a stance of 4.6 miles.

The improved routing of 2.9 miles f State Sign Route 36 in Humboldt ounty between 8.8 miles east of ridgeville and the South Fork of the an Duzen River will replace the resent 20-foot-wide treated gravel cility that has little or no shoulder nd is subject to flooding during rainy eriods.

The start of construction of all of he newly adopted routes will depend pon the availability of future highay funds.

IN MEMORIAM

District II

Paul A. Myers, Highway Maintenance Man II.

District III

Lester E. Hunt, Highway Foreman; Harold C. Altic, Janitor.

District IV

Donald Anderson, Assistant Highway Engineer.

District VII

Alvin Chaney, Garage Attendant; Ina Sebastian, Supervising Clerk II; Richard Withers, Assistant Highway Engineer.

District X

Joseph B. Bland, Highway Foreman.

District XI

Louis Celerio, Highway Landscape Leadingman.

Spec Section Loses J. W. "Wes" Coghill

John W. "Wes" Coghill, a 42-year employee of California Division of Highways, retired December 31, from his position with the division's Specifications Section.

During the past six years, Coghill has been responsible for issuing weekly progress reports indicating status of current highway projects throughout the state, keeping current records of budgeted projects, and many related duties.

His Highways career began in 1921, as clerk in the division's accounting section, then located in the Forum Building. After two years he became assistant chief clerk in the Headquarters Shop, 34th and R Streets, where he later became cashier and timekeeper. In 1928 he went to the District VI office in Fresno, as equipment clerk. He returned to Headquarters in Sacramento in 1947 to work in the accounting section; and in 1956 transferred to the Specifications Section.

Coghill was born in Cincinnati, Ohio, coming to California in 1909. He graduated from Sacramento High School and attended business college.

He is affiliated with the Masonic Lodge at Clovis.

Baumgart Retires From Records Section

Walter M. Baumgart, records management analyst for the California Division of Highways, retired on February 13 after 33 years in state service.

A native of Princeton, Indiana, Baumgart also attended grade and high school there. He worked as an accountant for a bank and private businesses before joining the Division of Highways in 1931 as chief of its headquarters files and mail unit in Sacramento.

Baumgart was one of the first employees to be assigned to the division's record management section, which was created in 1957 to reorganize and streamline its voluminous files. This streamlining has since been carried on through destruction of obsolete material, elimination of record duplication and transfer of infrequently used records to low-rent space in warehouses, all resulting in a substantial savings in office space.

Baumgart's assignments have taken him statewide both within the division and on loan to other divisions within the Department of Public Works. He has also participated in the training of other state personnel in records management procedures.

Baumgart's contribution to the records program has been especially valuable because of his wide knowledge of the contents and procedures of the existing files.

Baumgart and his wife have a son and a daughter and three grandchildren.

He is a charter member of the California State Employees' Association and of the State Employees Credit Union (he holds Passbook No. 16).

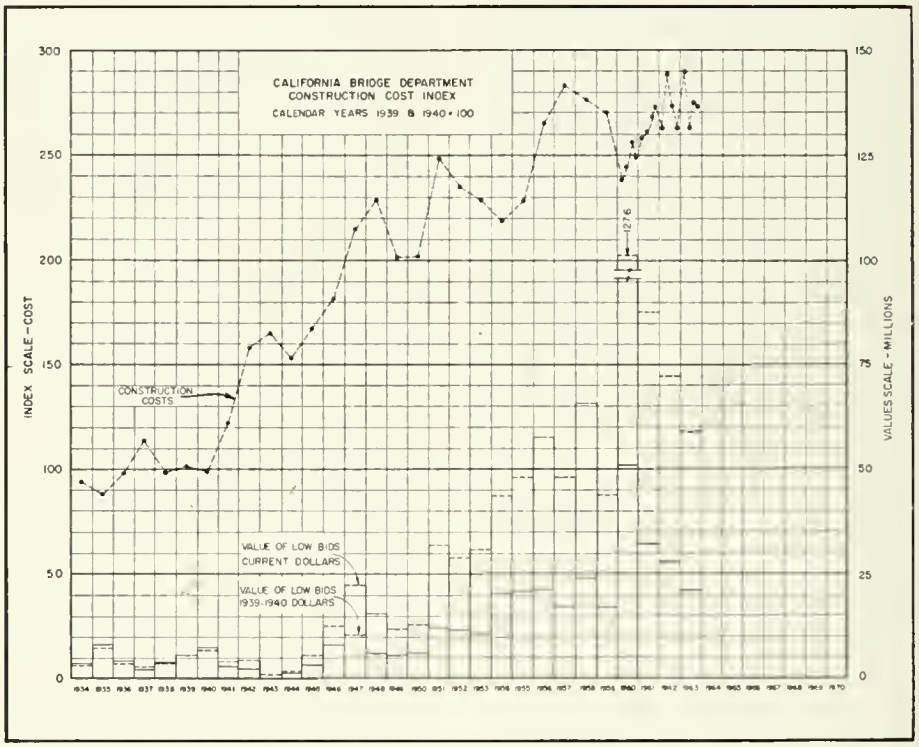
Bridge Costs

1963 Average Remains Same as Previous Year

By HARRIS K. MAUZY, Senior Bridge Engineer and
WILLIAM J. YUSAVAGE, Associate Research Analyst

The general level of bridge construction costs during 1963 were essentially unchanged from the level established in 1962. The annual average index for both years was 274. The corresponding annual average index for 1961 was 264 or one which indicates that the net increase in bridge construction costs over the past two years was of the order of 3.8 percent. It is of some interest to note that except for the year 1960 when the level of costs dropped to an average index of 248 all other values back to 1956 have clustered about a value of 270.

The general trend of construction costs as well as the trends of other relevant construction data are presented in the accompanying chart which summarizes the data of California bridge construction activity since 1934.



Construction Activity

During 1963 bids were received for 133 projects which included 422 bridges and a total value for bridge work of $59,388,693. The corresponding value for bridge construction during 1962 was about $72,000,000. The value for 1964 is expected to approximate $85 million.

Bidder Activity

Bidder activity, which was significantly curtailed during all of 1961 and the first three quarters of 1962, increased only moderately during the five succeeding quarters. The total number of bids submitted for 133 projects in 1963 was 843 for an average of 6.3 bidders per project. The corresponding averages for the four years, 1959 through 1962, were 8.8, 7.3, 5.8, and 6.0. The averages reveal a very definite correlation between strong competition and falling prices during late 1959 and all of 1960, and the subsequent stability in both the level of construction costs and the average rate of bidding.

Average Unit Prices

The weighted average unit price of most bridge construction items in 1963 showed only moderate variations from the corresponding prices of 1962. The general trends of the more significant items follow.

Class A Portland Cement Concrete. The amount expended annually for structural concrete represents about 45 percent of the total expenditures for all bridge items. The general trend of unit costs for concrete shows a downward movement from 1957 to 1960 with the cost moving from $58 to $50 per cubic yard. The trend reversed in 1961 when the unit price increased to $56 per cubic yard. The upward trend has continued into 1962 and 1963 with prices of $59 and $61 per cubic yard.

Bar Reinforcing Steel. The unusual downward trend of unit prices for bar reinforcing has continued through 1963. The weighted average unit prices for 1958 and 1959 were $0.124 and $0.113 per pound. In 1960 the price dropped to $0.097 per pound. During the subsequent years of 1961, 1962, and 1963, the corresponding unit prices were $0.094, $0.092, and $0.091 per pound.

Structural Steel (Plate Girder). The summary unit price of structural steel now includes the quoted prices of A-36 and A-441 steels as well as A-7. The previously specified A-373 type of steel has been deemphasized and the higher strength A-36 steel is now favored. The inclusion of the costs of the higher strength steels will exert a slight upward bias on weighted average structural steel prices but since the dominant addition will consist of A-36 which has been quoted and found costing about 4 mills additional per pound, the overall distortion will be minimal.

Weighted average unit prices of teel have been relatively stable over ne past five years; average unit prices or the years 1959 through 1963 were 0.163, $0.169, $0.173, $0.184, and 0.172 per pound for the five years espectively. In recent months there ave been several quotations which ropped to as low as $0.15 per pound ut these are rare; the largest number f quotations continue to fall gener-lly within the limits of $0.17 to 0.185 per pound.

Prestressed Concrete. The sum-ıary unit price of prestressed con-rete is expressed in terms of the price f a composite cubic yard of pre-resesd concrete in place. The unit rice accordingly includes the cost of ɔncrete, reinforcing steel, stress steel, ıchorages, prestressing operations, as ell as the cost of erection.

The corresponding weighted av-rage prices per composite cubic yard f prestressed concrete for the years 955 to 1962, inclusive, are $135, $163, 165, $145, $135, $139, $150, and $146. uring 1963 the price increased to 166.

The large variations in the cost of ıe item arise partly from the com-ɔsition of the kinds of prestressed ɔncrete work for any given year. A eighted average price of $166 per ɔmposite cubic, for example, is indi-tive of the greater proportionate use the higher priced precast pre-ressed "I" girder, whereas a price of 50 is indicative of the greater pro-ɔrtionate use of the less expensive st-in-place prestressed type of con-ruction.

Conclusion

The last few years have been char-terized by an unusually protracted eriod of stability in construction ɔsts. During the past three years idge construction costs have fluc-ated within a range of variation of out 4 percent and during the last o years there has been no change in e level of construction costs. Con-ɔmitantly, bidder activity also has en constant—at an average rate of out six bidders per project. The ttern of bidders as well as the level bid prices during the first weeks of 64 indicate that the established pat-rn is continuing into the new year.

Neil Dunham Named Computer System Head

Establishment of a new position of computer systems engineer for the California Division of Highways and the appointment of A. N. Dunham to the post have been announced by State Highway Engineer J. C. Womack.

Dunham, who joined the Division of Highways in 1946, is being promoted from assistant engineer of design.

NEIL DUNHAM

He will be responsible for all electronic data processing operations of the Division of Highways.

The highway engineering applications of electronic data processing by means of computers have expanded in recent years, Womack said, far beyond the original uses of traffic data coding and a few types of engineering calculations. They now include earthwork quantity calculations, structural analysis for pavements and bridges, right-of-way calculations, profile grade and elevation data, and traffic analysis. The entire state highway accounting operation has now been converted to electronic data processing.

Establishment of a computer systems unit separate from the urban planning activity was recommended by the Division of Highways management consultants, Price-Waterhouse and Company, in 1963.

Although born and raised in San Diego, Dunham received his civil engineering degree in 1947 from the University of Illinois where he had studied under the U.S. Navy college training program. He held various engineering assignments of increasing responsibility in the San Diego district until March 1961, when he was promoted to supervising highway engineer and transferred to division headquarters as assistant engineer of design.

Dunham and his wife Joyce have three children. He is a member of the American Society of Civil Engineers.

Bay Toll Crossings Loses Edwin F. Levy

Edwin F. Levy, senior bridge engineer with the Division of Bay Toll Crossings, retired on February 29, completing a 32-year career with the San Francisco–Oakland Bay Bridge.

Levy was born in San Francisco. He attended grade school and was graduated from Lowell High School there. He graduated from the University of California in 1927 with honors.

The first five years of his engineering career was spent on dam and building construction with contracting firms in the Bay area.

EDWIN F. LEVY

He joined the design organization of the Bay Bridge in 1932 and played an important part in the design of the bridge and the Transbay Transit Terminal.

In 1948 he was advanced to division office engineer and for the next two years supervised studies for a second bay bridge and southern crossing. Since 1950 he has been in charge of design and maintenance for the operating agency of the Bay Bridge and other state toll bridges. When the Dumbarton and San Mateo–Hayward Bridges were purchased from private owners, Levy supervised the effort of converting to state ownership, and acted as manager for those bridges during the initial period of State operation.

Levy's contribution to the operating function of the State's toll bridges has been especially valuable because his experience, combined with his intimate knowledge of the design, construction and maintenance problems of the San Francisco–Oakland Bay Bridge, make him a leading authority on the subject.

Levy is a fellow of the American Society of Civil Engineers. He is also a registered structural engineer and a member of the Commonwealth Club.

He and his wife, Jeanette, plan to embark soon on a six-month world tour.

New Job Classes

Will Recognize Special Skills Required in Landscape Maintenance

A comprehensive study of highway landscape maintenance operations has led to establishment of two new classes by the State Personnel Board, plus several revisions in present classes in the series.

This reorganization, effective February 6, 1964, provides an avenue for promotion within the landscape maintenance series and recognizes the special skills required to perform landscape maintenance work.

The two new classes are highway landscape maintenance man ($440–486), and highway landscape foreman ($536–650).

Highway landscape maintenance man is the entry level class in the landscaping series. These employees maintain landscape and functional plantings, do weed control and soil sterilization work. They also operate light maintenance and landscape equipment, regulate traffic to insure safe working and traffic conditions, do litter cleanup on highway rights of way and perform minor roadway maintenance in emergencies. They must be qualified to operate any two-axle, single-motor vehicle towing another vehicle.

Transfer Examination

Groundsmen now serving on the highway landscape maintenance force of the Division of Highways will be transferred to the new class of highway landscape maintenance man by transfer examination, which consists of possession of a California driver's license valid for the above operations.

A highway landscape foreman may supervise a crew of from 4 to 15 subordinates and is responsible for the landscape maintenance work on extensive planted areas along freeways and highways. He supervises and instructs subordinates in this work; inspects highway planting contracts for compliance with contract plans and specifications. He investigates and prepares reports of damage to highway facilities, makes repairs to landscape facilities and keeps costs in this connection; and he may supervise a crew on minor highway maintenance work in emergencies.

Duties of a highway landscape maintenance man include functional planting, weed control and soil sterilization work, litter cleanup and operation of light maintenance and landscape equipment.

Revised specifications and title changes apply to four classes.

Employees Reclassified

Employees in the class of highway landscaping leadingman will be retitled highway landscaping leadingman and will receive a one-step salary increase, the new range being $463–562.

In the other title change, highway landscaping supervisor I, II and III become highway landscape specialist I, II and III.

Adoption of this reorganization will result in some change in the line of supervision. Responsibility for all

gular and landscape maintenance
erations in a given territory will be
signed to the Highway Superin-
ndent in charge of the territory.
egular maintenance crews, except
r very short-term assignments, will
t be used on landscape maintenance
less the amount of landscaping is so
all that a full-time landscape main-
nance man is not warranted. Land-
ape crews will not be used on
gular maintenance activities except
emergencies.

The highway superintendent, who
s supervision over all maintenance
rsonnel, may delegate direct super-
sion of landscape crews in accord-
ce with specified procedures, as a
ction changes from one with little
no landscaping to one which is
lly landscaped. Under certain con-
ions, a highway landscape specialist
may be placed in charge of the
eration and will report to the ter-
ory superintendent.

Staff Capacity

A highway landscape specialist I
o may act in a staff capacity to
ist the district maintenance engi-
er on landscape maintenance in
her than a large district. He will
ve districtwide responsibility in-
uding preparation of cost estimates
landscape maintenance, tree trim-
ng, and other ground improvement
ork for budget purposes. He con-
ts with and advises highway super-
endents, resident engineers and
dscape architects. Review of plans
d specifications for soil erosion
ojects, and other related duties may
o be his responsibility. Similar
ties in a large district may be per-
rmed by a highway landscape
ecialist II. The class of highway
dscape specialist III will be used in
eadquarters Maintenance Depart-
nt only.

GREMLIN CORNER

One of our sharper-eyed readers,
. E. Young, of Oakland, has pointed
t a typesetting error in the January-
bruary issue of the magazine. In the
ond column of Table I on page 10
4,229" should read "42,229."

DIVISION OF HIGHWAYS LOSES 24 TO RETIREMENT

The following employees have retired from the Division of Highways since the last list published in the January-February 1964 issue of "California Highways and Public Works."

District I

Leo Swithenbank, highway maintenance man II, 37 years; Harvey J. Rivers, highway maintenance man II, 32 years.

District II

Jess B. Doyle, storekeeper I, 29 years; Edmond N. Crews, highway maintenance man II, 35 years.

District III

Elwood M. Culveyhouse, highway maintenance man II, 30 years; George A. Harbey, highway foreman, 34 years; Wilfred Gwinneys, highway maintenance man II, 7 years.

District IV

Frederic Spalding, assistant highway Engineer, 15 years; Wayne A. Ladd, skilled laborer, 16 years.

District V

Charles L. Biggs, highway superintendent, 42 years; Raymore McManus, highway maintenance man II, 12 years; Isaac R. Parrish, highway maintenance man II, 33 years.

District VII

William A. Mitchell, highway maintenance man II, 36 years.

District VIII

Pearl F. Lucas, highway maintenance man II, 34 years; Randall Lauterborn, highway maintenance man II, 32 years; Henry N. Noble, assistant highway engineer, 30 years.

District X

Richard Spradling, highway foreman, 32 years.

District XI

Ruland Faulk, janitor, 24 years; Robert Rodgers, highway engineering technician I, 3 years.

Headquarters

Wyatt C. Winkler, associate highway engineer, 28 years; Rose B. Cumming, senior stenographer, 11 years.

Bridge

Winnifred Saunders, senior stenographer, 2 years.

Shops

Evelyn Rosenbaum, accounting technician II, 8 years; Lester Hutcheson, heavy equipment mechanic, 12 years.

Nelson Spicklemire Retires in Redding

Nelson E. Spicklemire, associate bridge engineer, retired on February 1. He had been with the division since 1933 when he was appointed party chief on the San Francisco–Oakland Bay Bridge preliminary crossing surveys.

Spicklemire's assignments as Bridge Department representative on construction projects have taken him throughout the State from Tijuana to Crescent City.

A native of Tulare, Spicklemire received his degree in engineering from the University of California at Berkeley.

He joined the U.S. Navy during World War I and served as ensign on destroyers and subchasers.

He worked on railroad relocation and in private practice until joining the division.

In 1936 he transferred to the Bridge Department in Los Angeles. Since 1953 he has been assigned to the District II area with headquarters in Redding.

Spicklemire and his wife, Marge, have two daughters and four grandchildren.

Spicklemire speaks Spanish fluently, and he and his wife plan to travel extensively in Mexico and Latin American countries.

The Division of Highways has called for bids on the first phase of a $4,320,000 project to extend the Interstate 5 freeway construction in Shasta County north of Red Bluff to two miles north of the Tehama county line.

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C. RAY VARLEY . . . . . Assistant Director
JUSTIN DuCRAY . Departmental Management Analyst
S. ALAN WHITE . . Departmental Personnel Officer

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J. A. LEGARRA . . Deputy State Highway Engineer
GEO. LANGSNER . . Deputy State Highway Engineer
LYMAN R. GILLIS . Assistant State Highway Engineer
J. E. McMAHON . . Assistant State Highway Engineer
FRANK E. BAXTER . Assistant State Highway Engineer
GEORGE A. HILL . Assistant State Highway Engineer
J. C. BURRILL . . . . . Comptroller
NEAL A. ANDERSEN . . . . Equipment Engineer
JOHN L. BEATON . . Materials and Research Engineer
C. G. BEER . . . . . Urban Planner
A. N. DUNHAM . . Computer Systems Engineer
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W. L. WARREN . . . . . Engineer of Design
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A. L. ELLIOTT . . . . Bridge Engineer—Planning
R. J. IVY . . . Bridge Engineer—Special Projects
I. O. JAHLSTROM . . . Bridge Engineer—Operations
DALE DOWNING . . Bridge Engineer—Southern Area

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DEXTER D. MacBRIDE . . . . . Assistant Chief
RAY E. O'BIER . . . . . Assistant Chief
R. S. J. PIANEZZI . . . . . Assistant Chief

District I, Eureka

SAM HELWER . . . . . District Engineer

District II, Redding

H. S. MILES . . . . . District Engineer

District III, Marysville

ALAN S. HART . . Assistant State Highway Engineer

District IV, San Francisco

J. P. SINCLAIR . . Assistant State Highway Engineer
R. A. HAYLER . . . . . District Engineer
HAIG AYANIAN . . . . . District Engineer
C. F. GREENE . . . . . District Engineer

District V, San Luis Obispo

R. J. DATEL . . . . . District Engineer

District VI, Fresno

W. L. WELCH . . . . . District Engineer

District VII, Los Angeles

E. T. TELFORD . . . Metropolitan District Engineer
A. L. HIMELHOCH . . . . . District Engineer
A. C. BIRNIE . . . . . District Engineer
A. W. HOY . . . . . District Engineer
R. E. DEFFEBACH . . . . . District Engineer

District VIII, San Bernardino

C. V. KANE . . . . . District Engineer

District IX, Bishop

C. A. SHERVINGTON . . . . . District Engineer

District X, Stockton

JOHN G. MEYER . . . . . District Engineer

District XI, San Diego

JACOB DEKEMA . . Assistant State Highway Engineer

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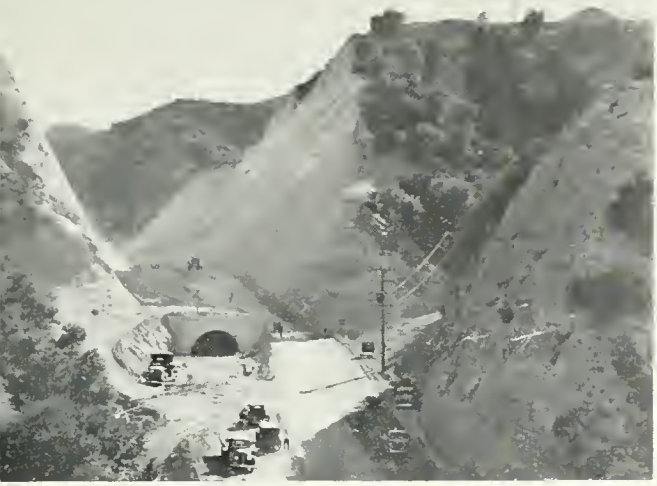


1938 a cut was made straight through the ridge and the troublesome old tunnel removed.

View of section today where tunnel once was situated. Road has been widened to four lanes with raised median, is slated for conversion to full freeway.

(Continued from inside front cover)

dbed was graded and oiled. But it s still steep, and it became the cus- n for San Joaquin automobile tomers who bought their cars in s Angeles to refuse to take delivery ess the car could make the Newhall ade.

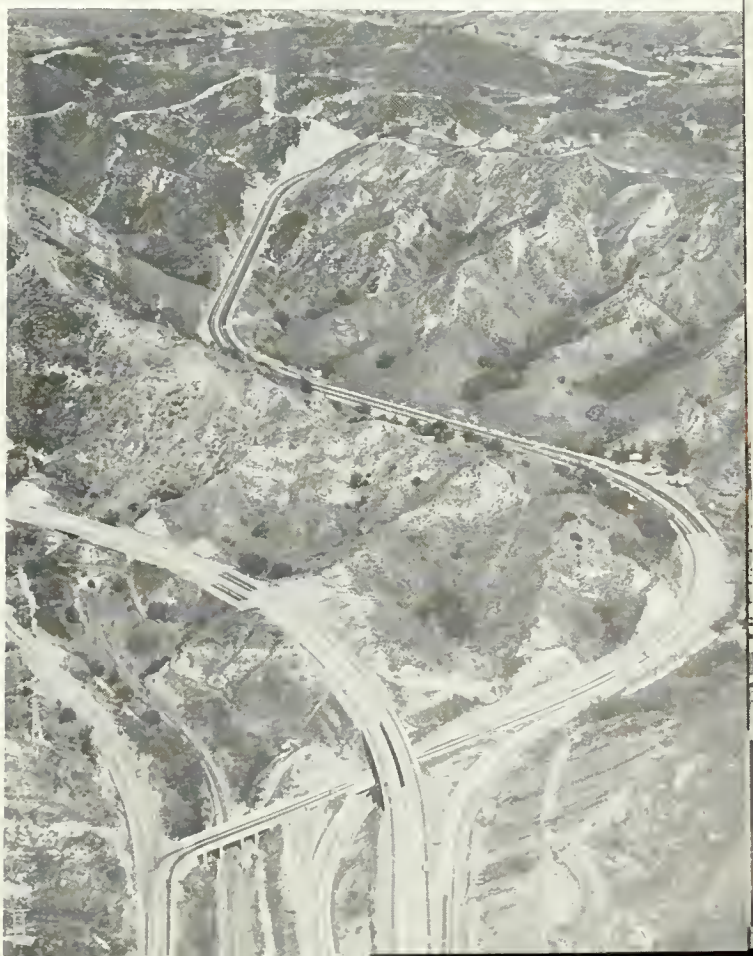
Automobile traffic had so increased 1910 that one man made a comfort- e living waiting at the pass with a team of horses ready to pull any car over, but he was forced out of business when the County of Los Angeles opened a tunnel through the ridge in October 1910, eliminating the terrors of the old grade.

The Newhall–Saugus route became a state highway in 1917, and carried all the U.S. 99 traffic until 1930, when the Weldon Canyon route to the west was opened.

Both routes now have been widened to four lanes. The U.S. 6 section will become full freeway soon as an extension of the Palmdale–Lancaster route, and the Weldon Canyon route is slated for eight lanes of freeway as part of Interstate 5. Mr. Hamlin while struggling over the summit in 1902 couldn't have realized what he was starting.

rial view of San Fernando Pass area. U.S. 99 is visible passing across oto at top, U.S. 6 (new Route 14) in foreground. Tunnel was in cut area, extreme lower right, and old pass is plainly visible lower left.

Interchange area, U.S. 99 and U.S. 6 (new Route 14). Old tunnel area is in upper center, old pass visible as light streak just to right of it. Old pass is easily accessible to sightseers.



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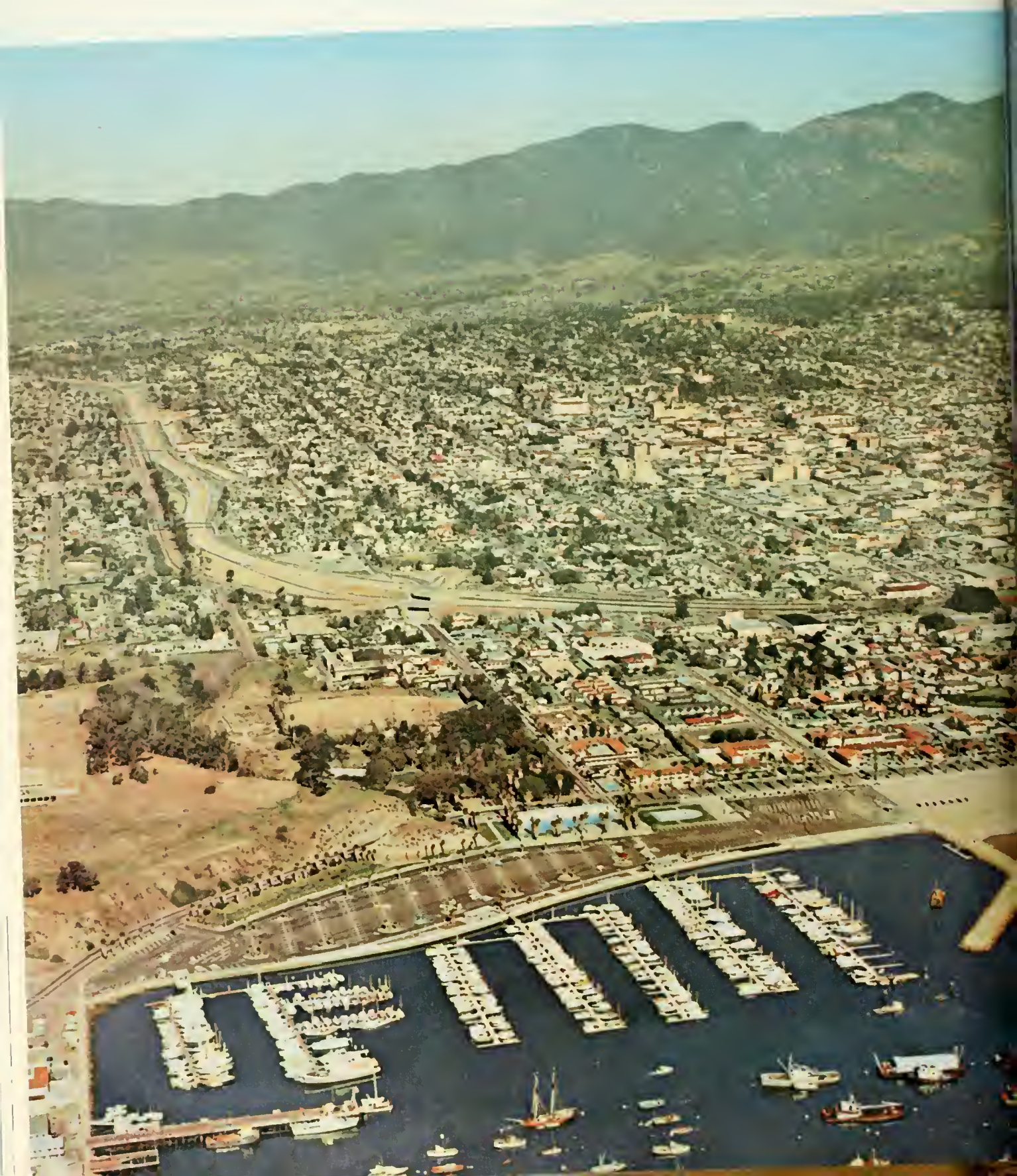

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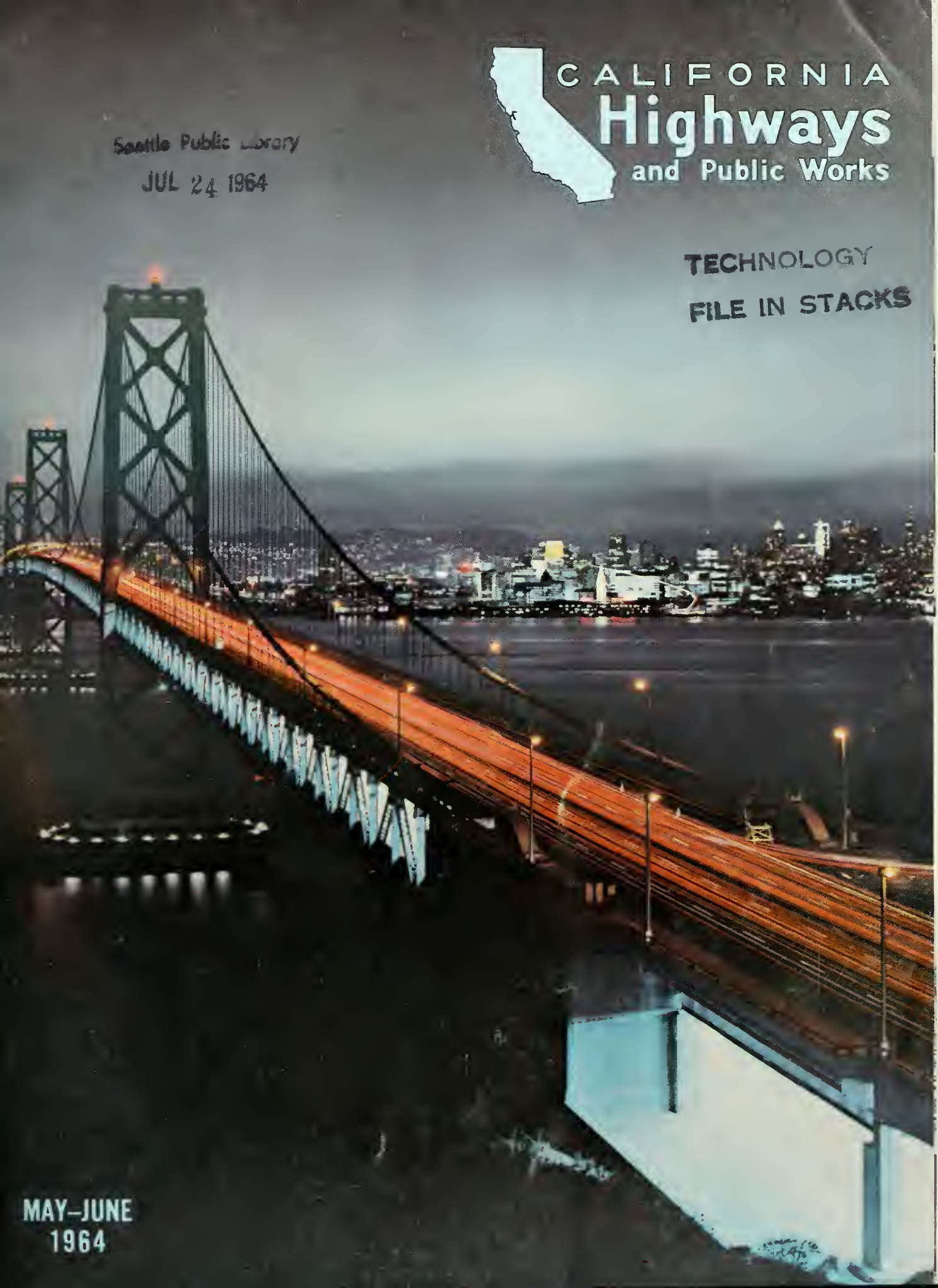

MAY–JUNE
1964

Landscaping on a Freeway Interchange

Plantings at the Willow Road Overcrossing on the Bayshore Freeway in Menlo Park include rock roses in the extreme foreground backed by a bottle brush plant. Tree at left is a coast redwood and one on right is liquidambar. Masses of ground cover are ice plant, backed by a bank of mixed shrubs on the embankment. *See "Bay Area Report—1964" beginning on page 24.*

Editor's Note: This landscaping project was designed by the Roadside Development Section, Division of Highways, headed by Supervising Landscape Architect H. Dana Bowers. The editorial, quoted below, appeared in the April 30 issue of the Palo Alto *Times* under the title of "Miss Interchange—Our Nomination." An editorial and photo along similar lines, referring to the Bayshore Freeway-Harbor Boulevard interchange in Redwood City, appeared in the May 8 issue of the Redwood City *Tribune*.

"Freeway interchanges devour money and land and when built usually have looks only a fatherly civil engineer could love.

"In many cases, however, landscaping can lift their curse of ugliness. In rare cases, plantings can transform the potential wasteland within the cloverleaves into really attractive scenery. One can, indeed, visualize some of these park-like byproducts of the automobile age as future oases amid asphalt, concrete, steel, whizzing vehicles and boxy buildings.

"The Willow Road Overpass at Bayshore Freeway in Menlo Park is one such rare case. We dare, in fact, to advance the claim that it's the best landscaped interchange on the peninsula, if not in the whole State.

"This is the time of year when it looks best. We habitually cross it with a silent word of thanks to its designers, whoever they were."

California Highways and Public Works

Official Journal of the Division of Highways, Department of Public Works, State of California

Vol. 43 May-June Nos. 5-6

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FRONT COVER: One way to illustrate the new traffic flow on the remodeled San Francisco-Oakland Bay Bridge is to photograph it at night. Westbound traffic on the upper deck shows only its tail lights, while the lower deck is illuminated by the headlights of eastbound cars. Bright area lower right was once occupied by commute train rails. See "Bay Area Report," page 24. (Photo by Bill Ruland.)

BACK COVER: Modern freeways such as the San Diego Freeway (Interstate 405) in Los Angeles have built-in safety features. With grade crossings eliminated (note undercrossing for Sepulveda Boulevard in right foreground), adequate shoulders and a wide median strip enhanced by chain-link protection, eight lanes of traffic move smoothly through this metropolitan area. See "Freeway Fatalities" page 20. (Photo by John Meyerpeter.)

Crossing the Eel River from Scotia to Rio Dell in early 1900's. This was the ubiquitous Model T of the period, with the brass radiator shell.

The Redwood Highway

Part I — *Early History of Transportation in the Northern Coastal Counties*

By John Robinson, Information Officer

In the first 50 years or so of settlement in the north coastal region of California, few people gave thought to a north-south highway from San Francisco to the Oregon line. The Redwood Highway was not even a dream. Eureka, Arcata; Trinidad, and Crescent City considered themselves seaports for freight to and from the Northern California valleys, and the smaller towns near the coast depended upon these ports for export of their raw materials, and import of their needs.

Almost all the early settlement along the north coast in Humboldt and Del Norte Counties was near harbors where supplies might be landed from ships and transported inland to the many mines and diggings in the Klamath Mountains. Today hardly any of these early mining townsites are marked, and many are completely effaced; yet when they were operating they required tremendous amounts of freight every week to keep them going. It all came in by sea.

Sea Transport Cheapest

By 1855 logging had taken its place as the leading industry in the north coast, but sea shipment was still much cheaper than any overland method, and the towns still faced toward the sea, were still oriented east and west. Although storms and tides sometimes kept shipping away for months, communication with the rest of California was infinitely easier by water than over the tortuous, frightening trails which wound their way southward. Also, because of the mining camp commerce, the roads and trails to Redding and Red Bluff were better marked and developed than to Ukiah.

Another deterrent to roadbuilding in Humboldt County was the early development of the railroad there. In 1854 Humboldt County had the first railroad in the state, and by 1890 a dozen railroads fanned out from the Humboldt Bay region. Most of these were primarily logging railroads, but several handled freight and passengers.

Early-day Railroading

An anecdote of an early-day railroading incident on the outskirts of Eureka gives an idea of what this service was like on some railroads. The train, horse drawn, was proceeding downgrade toward the seaport with a load of passengers and their baggage, which were scheduled for embarkation on a ship sailing a few hours hence. Crossing a trestle over a ravine about 15 feet deep, the horse somehow got tangled in the traces

nd fell over the side, kicking and hinnying as he hung suspended by he harness about halfway down.

One of the passengers, possibly omewhat under the influence, decid- g a major catastrophe was upon hem, yelled "Jump for your lives!" nd sailed out into space to land feet rst, waist deep, in the mud at the ottom of the ravine. In due time, ith passengers assisting, the horse as cut free and hitched up again ith patched harness, the hapless pas- enger rescued from the mud, and the ain continued to its destination. No ijuries were suffered.

Crescent City to Grants Pass

Although the northern end of the edwood Highway, that section from rescent City to Grants Pass, was not ncluded in the state system until sev- ral decades after inclusion of the oute from Arcata to Crescent City, was a very important commercial oute from the beginning. Crescent ity, founded in 1853, for some time xceeded Eureka in freight tonnage, nce it served all the southern Oregon ines as well as most of the diggings n Siskiyou and Del Norte Counties.

In the early 1850's most of the reight went out on pack trains, up old Spring Mountain Trail. This as roughly the route of today's US 99, although it veered a few miles ast of the present summit. In these ears sometimes 500 mules a week eft Crescent City, and, until the con- truction of the Southern Pacific Rail- oad in 1875, almost all of the freight or towns as far east as Yreka went hrough Crescent City, as well as a reat deal of southern Oregon's sup- lies.

Mule Packtrain

In the Crescent City of the 1850's nules were as common a sight as auto- nobiles today. Packtrains were usual- y made up of 20–30 mules, which ent out on the trail tied in a line, ail to head, a bell on the leader to arn other trains. Two to three men ode with the train, one leading, the thers watching the rear.

A typical train carried about 2½ ons. The packs held sides of bacon, ags of flour, kegs of whiskey, sugar,

Crescent City in 1855. Drawing by R. Hill. At that time the city had over 700 residents and many transients. Large numbers of mules left daily for Sailor Diggins, Alt House, Orleans Bay, Happy Camp, Indian and Deer Creeks, Jacksonville, and Yreka. (Courtesy of California Section, State Library.)

ABOVE: Road through Healdsburg, 1859, shows fine disregard for traffic hazards such as trees in the street. (Courtesy of California Section, State Library.) BELOW: Eureka in 1864. View is up G Street between third and fourth Streets. This is now heart of the city, and third and fourth are now a one-way couplet through town until a freeway can be built. (Courtesy of California Section, State Library.)

Pack train moking up for trip from Humboldt Bay into Hoopo Valley, about 1880. This is a large train of perhops 50 mules, with several pockers. Note borrels ond boxes in pocks; ond pocker in center tightening hitch. (A. W. Ericson photo, courtesy of Clarke Memorial Museum, Eureko.)

coffee, baking soda, matches, whale oil, lard, salt, frying pans, gold pans, nails, hammers, shovels, picks, and ammunition, in the realm of necessities; and to the richer diggings almost anything a luxury-hungry miner might want. There is a story that a piano was carried by pack train from Crescent City to one mining camp gambling house.

Since a double freight wagon with an 8- or 10-horse team and one driver could carry more freight than a 30-mule packtrain, the "Crescent City Plank Road and Turnpike Company" was organized in 1854. Problems of financing and construction, as well as Indian wars, held up the road until 1858, when the first stage traveled over it from Oregon Territory. This was a toll road, with tolls collected at the ferry over the Smith River. A two-horse team cost $5, a four-horse team $8, a six-horse team $10. The road was passable only from April or May until the return of wet weather, but a four-horse team could haul 3,000 to 3,500 pounds of freight "over the hump." By 1874 this road was in bad repair, and the citizens of Josephine County with difficulty raised $3,000 in taxes to fix up their end. The levy provided that taxpayers could pay or work out their tax on the road.

In 1882 a new toll road, the Wimer Road, was opened; starting at the coastal end farther north, it followed roughly along the state line, but reaching eventually the site of Cave Junction, as all the other routes had. It bypassed a hotel operated by a Frenchman named Gasquet who, since 1877, had been operating a large traveler's inn part way up the Smith River Canyon, with French cooking, sleeping cabins, store, saloon, blacksmith shop, butcher shop, and many other outbuildings for poultry and livestock. In clearings nearby he raised corn, potatoes, table vegetables, fruit and grapes. (In 1947 some of the Gasquet buildings burned; the remaining ones were razed in 1959.)

Gosquet Toll Rood

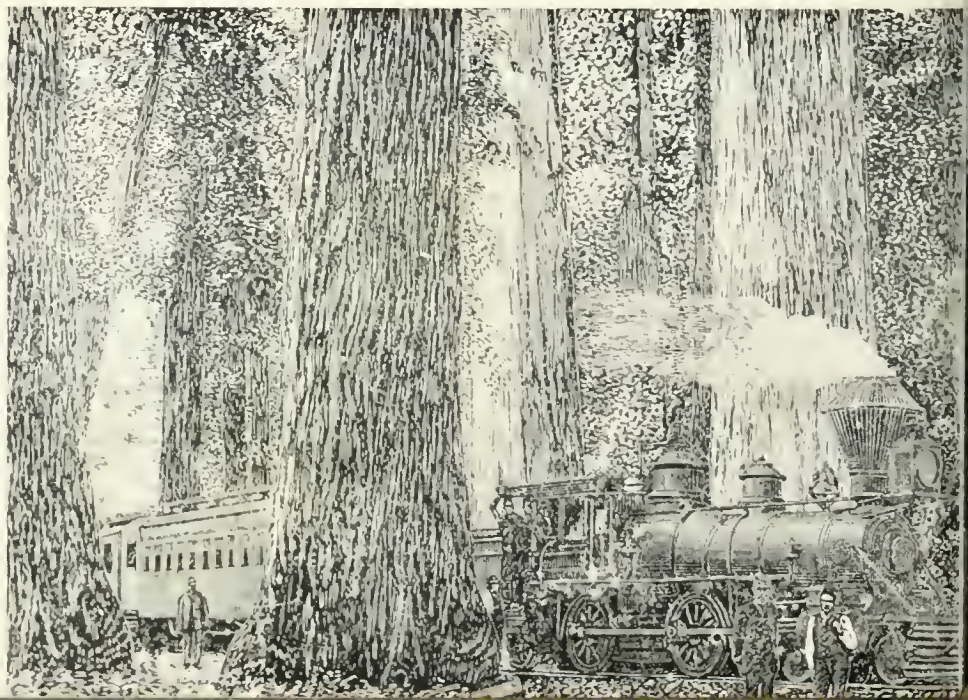
Apparently to protect his investment, Mr. Gasquet in 1887 opened the Gasquet Toll Road, the best road so far, built with black powder and Chinese labor. It eliminated one of the worst features of the Wimer Road: its 1,500-foot drop into the canyon of the North Fork of the Smith and out again.

The Gasquet route was essentially that of the present US 199, except that near the summit it ran a few miles west until it crossed the Oregon line. It joined the future US 199 route at O'Brien and proceeded on to Grants Pass via Vannoy's Ferry across the Rogue River. Much of this road can still be traced through the rugged mountainous terrain.

On the Oregon side the commissioners of Josephine County did their best to keep the route serviceable. The county was too poor to build bridges over the numerous streams, but the commissioners took over issue of ferry licenses and levied a $3 fine if travelers were not taken in order of arrival. The ordinance stipulated priority was only to be given midwives and county commissioners.

By the late 1880's there was a bridge at Grants Pass over the Rogue, and stagecoaches left both terminus

Line drowing from photogroph, showing Pacific Lumber Company's roilroad between Scotio and Alton, about 1890. Although these were essentially logging roilroads, they were importont to local transportotion os evidenced by passenger cars ond full crew. (From "History ond Business Directory of Humboldt County, 1890-91"; Daily Humboldt Standard.)



ities daily. There were 10-passenger oaches, with open sides and roll-lown currains. The body rested on ix thick laminated leather strips four nches wide (thorobraces) which erved as springs. The body was red; he wheels had two-inch-wide steel ires. Four to six horses drew these ehicles at six miles an hour on the evel, with loudly squeaking axles and owering clouds of dust. In 1900 the are for the 200-mile trip from Cres-ent City to Grants Pass was $6.

Arrival of Telephone

The first symbol of modern civili-ation was the linkage of Crescent City and Grants Pass by telephone in 897. In 1901, at the height of the icycle craze, it became the thing to lo to ride between the two cities, nuch as it became the craze recently o hike 50 miles.

In 1914 Frank Bosch put auto-nobile srages on the Crescenr City-Granrs Pass run. These were two-ylinder International Harvesters with igh wheels to cope with the ruts and ord the streams, and were designed vith easily accessible parts for repairs nd easily removable tires for replace-nent.

In the early 1920's the road was so nuch improved it was possible to nake the trip from Crescent City to Grants Pass in 14 hours. An average of four to five miles an hour speed was good for substantial portions of the route.

Stewart Mitchell, Jr., remembers raveling this road as a child, about 1923, in a Pierce Arrow stage which took all day to make the trip. Pas-sengers stopped for lunch at either O'Brien or Cave Junction, and arrived in Granrs Pass after dark. The body of the stage stuck out a considerable distance beyond rhe rear wheels and on many of the sharp curves it was necessary to back and turn to nego-tiate the curve. Stewart, who was sit-ting in a rear sear, remembers looking over the side and discovering there was no road, only the cliff dropping sharply away beneath him.

The route became a state highway in 1927, and was realigned and paved within the next few years. In the early 1930's most of the old Gasquet route had been abandoned.

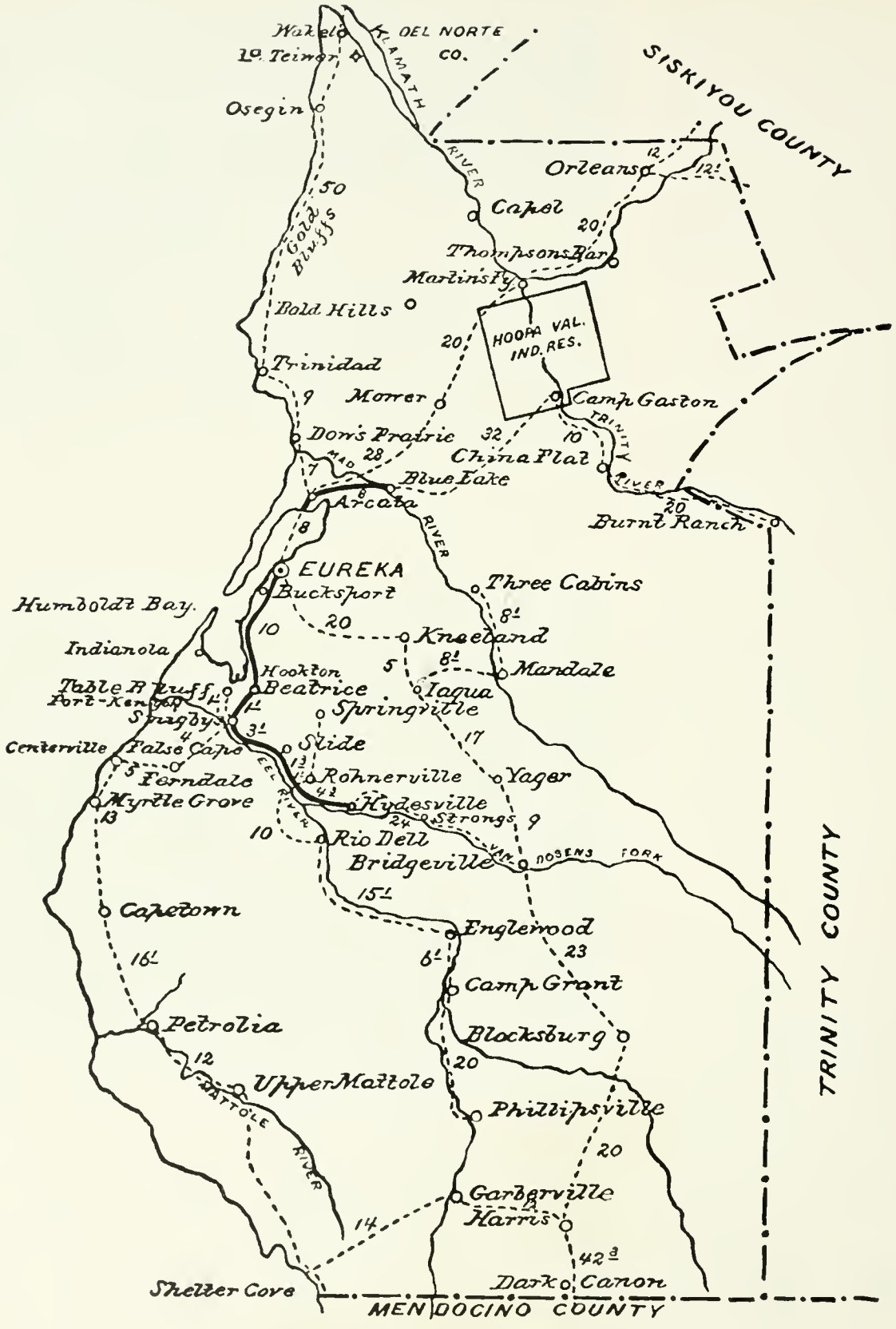
Eight-horse team and double freight wagon photographed in Del Norte County around 1900. It would take about 100 of these or several thousand mules to equal the work of one modern truck and trailer combination. To equal today's 160-truck average on the route between Crescent City and Grants Pass, a constant line of loaded mules moving in both directions, head to tail, would be needed. (Photo courtesy of Rev. Dan M. Chase of Jackson.)

Four-horse team and stage coach photographed at Old Shasta in 1912, typical of stages still operating in dry season over mountain roads in northern California at that time. Most roads were impassable in winter except on horseback.

Eureka to Crescent City

The last section of the Redwood Highway to be developed was the connection between Crescent City and Eureka, despite the fact that Jedediah Smith traveled part of this route in 1828, and Dr. Josiah Gregg in 1849-1850. Settlement was sparse, although Trinidad was a booming seaport in the early 1850's, where mules for packtrains to the mines were pushed overboard from ships in the harbor and allowed to reach shore on their own initiative, then rounded up.

North of Trinidad the Klamath River was the big obstacle. It was too deep to ford, and riders had to swim their horses across. It was customary to wait around on the bank until an Indian came along in a canoe and then



MAP OF HUMBOLDT COUNTY

This map of Humboldt County roads in late 1880's shows rugged Kneeland-Bridgeville-Blocksburg Route, also coastal route via Petrolia. Note there was no route up the South Fork of the Eel beyond Phillipsville. (From "History and Business Directory of Humboldt County, 1890-91"; Daily Humboldt Standard.)

tchhike a ride across, or, if there as a boat in sight, to borrow it and it up on the other side. In 1890 a ck of 1,800 sheep was ferried across Indian canoes.

Indians used canoes to travel from e Klamath to Crescent City. Whites metimes used surfboats. A twisting, nding road through great redwood oves and along the beach, was com-eted in the early 1890's, with a ferry the Klamath River at Requa. hrough the groves it was necessary pave with redwood slabs over the ft soil, and, although these were rd on a wagon, they were service-le and picturesque.

By 1894 stages were running from ureka to Crescent City, a two-day ip. In 1895 a cable ferry was installed the Klamath, operating on river ower. Later this was operated on soline until the bridge was opened the late 1920's.

In 1911 auto stages were running er the route, taking 8–12 hours to avel the 100 miles or so of muddy rest and sand beaches in wet eather, dusty forest and sand beaches hen dry, backing and filling two to ree times in hairpin turns. Judge alk of Eureka tells of a friend of his ho drove this route about this time, an election year. He particularly oted the posters for coroner, which ptly seemed to be located on every air-raising curve.

Douglas Memorial Bridge

When the Douglas Memorial Bridge cross the Klamath was opened in the late 1920's, a dream of more than 30 years was fulfilled for Del Norte County residents. There seemed at last promise of fulfillment of their other dream of a fine highway connecting them with Eureka and the San Francisco Bay area.

The history of the development of the routes to the south and north of Crescent City illustrates the problems of freight movement and commerce in the pioneer days in the north coastal area. Records of the State Engineer in the 1900's shed light on route selection and road building when the infant highway system was beginning to spread through the State.

San Francisco Ferry House about 1890, when the horse was still the mainstay of short-haul transportation, but mechanization was an its way. Streetcars in photo are divided about fifty-fifty between cable-drawn and horse-drawn. Compare with transportation development in north coastal counties at this time. (Courtesy of California Section, State Library.)

Light stagecoach and surrey on the Redwood Highway on old alignment between McDonald and Hopland in southern Mendocino County in the 1900's.

Since most of the lowland counties had developed usable road systems on their own, the State first turned its attention to laterals through the mountains, where county taxes and organizations were weak and road building costs high. Most of these east-west laterals studied were across the Sierra, but the Legislature ordered study of a route connecting Red Bluff, Redding, Weaverville, and Eureka, making Humboldt Bay accessible to the interior cities.

Sacramento River Steamers

Although the northern mines were served by steamers operating far up the Sacramento River in high water, and one craft had reached Redding as early as 1850, this form of transportation was uncertain much of the year due to fluctuation in river flow. By

Dungan's Ferry across lower Eel River between Ferndale and Loleta when coastal route south through Petralia was important. Picture made about 1885. Being transported are two young couples in one-horse gigs, one equestrienne, a young couple on foot, and two dogs, plus the operator. (A. W. Ericson photo, courtesy of Clarke Memorial Museum, Eureka.)

ABOVE: Sausalito Ferry Landing around 1890, with train of North Pacific Coast Railroad ready to pull out with transferred passengers. Note sailing ships anchored in harbor. (Courtesy of California Section, State Library.) BELOW: California Northwestern Railroad Station at Sebastopol early in this century. This is typical of the short-haul trains which connected many towns before adequate highways were built. As early as the 1870's this railroad ran to Duncan's Mills on the Russian River, whence stage coaches carried passengers north as far as Westport along coastal route now followed by SSR 1. Presumably, a traveler from here might make his precarious way via Usal and Petrolia to Eureka if conditions were favorable. (Courtesy of California Section, State Library.)

1854 the mines in the Weaverville vicinity were getting a big portion of their supplies from Eureka, by pack-train over a trail which in general followed the Trinity River along much the same route now followed by US 299.

With the development of the Salmon River mines, new trails were blazed, and existing trails were widened and improved as the people learned how to cope with the terrain. An example of how they learned "the hard way" was on one of these improved trails extending eastward from Orick which crossed the Klamath River at Martins Ferry, just downstream from the town of Weitchpec. In the early 1860's a suspension bridge hung here 97 feet above low water was swept away like matchwood, when the Klamath rose 120 feet.

As the mines around Weaverville were worked out, the Trinity route fell into disfavor, and most traffic used the Van Duzen River-Mad River route. It was not a very good road, and stagecoaches took 3½ to 4 days to make the trip. Nevertheless, it was the only usable connecting link for some decades, and was important during the period when the hydraulic mines had silted up the rivers to the extent steamers could not travel them, and before the railroad reached up into the valley. There were many petitions for improvement, since 3½ to 4 days was too long a trip for the fruit and produce the hopeful Humboldt Bay farmers wanted to ship to market and agriculture languished.

State Orders Survey

In 1903 a survey party in charge of G. W. Conners, and assisted part of the time by the State Engineer himself, Mr. Nathaniel Ellery, began a study of possible routes across the Klamath Range to the Sacramento Valley. Because of shortage of funds this was not completed until the Legislature got around to appropriating more funds in 1907.

Three possible routes were studied; the Trinity River route now used by US 299, the Van Duzen-Mad-South Fork of the Trinity route now used by State Route 36, and an intermediate route which lay north of the Van Duzen, but eventually worked southward and arrived at Peanut, the same destination as the Van Duzen route.

The engineers in charge of the surveys were told to keep in mind the following eight principles:

1. Public service.
2. Possible development of territory.
3. Distances, grades, elevations, and mileage to construct.
4. Character of ground traversed and bridges required.
5. County road approaches.
6. Cost of construction.
7. Snow and sun exposure.
8. Maintenance after construction.

These same principles are still today major factors in the economics of road construction.

Southern Route Recommended

After a thorough study of all three routes, it was decided to recommend the southern one. It was cheaper to construct, distances and grades were comparable to the other routes, county road approaches were equal in the west, but superior on the east end, and service would be about equal. The recommendation also urged start of construction at the earliest possible date in the spring of 1909.

Work was in fact begun in 1909, and during a 5½-month period an average of 40 men were engaged on the project. They moved 2,845 yards of dirt with plow and scraper at a unit cost of $0.125; 23,455 yards with pick and shovel at a unit cost of $0.352; and 6,166 yards of solid rock at a unit cost of $0.93. Specifications called for a 12-foot roadway with ample, 18-foot turnouts.

Construction continued each season, and on October 3, 1912, Department of Highways road engineer Fibson drove an automobile from the Mad River over the road to Peanut and thence to Red Bluff—the first motor vehicle over the new road. Later there was an official celebration with an

o procession from Eureka to Red
iff and Redding. Heavy traffic was
nediately generated over the high-
y, with 200 automobiles and 50
ms in 1914, increasing to 670 auto-
biles and 150 teams in 1915. This
d is in the state system today as
n Route 36.

Eureka to San Francisco Bay Area

The road between Eureka and the
area, that section of the present
dwood Highway which today car-
the most traffic, was almost as
w in being developed as the portion
ween Eureka and Crescent City.
e L. K. Wood party in 1850 blazed
rail up the Russian River, through
ng Valley, and down to the Eel
uth Fork at Garberville. As early
1856 the State Surveyor General
ommended to the Legislature a
),000 appropriation for a road from
caluma to Humboldt Bay via Santa
sa, the Russian River and the Eel.
e Legislature voted no funds, but
horized counties to collect poll tax
road construction if they so de-
ed.

This route was not developed very
pidly for a number of reasons. For
e, the Indian wars in the north coast
gion in the 1850's and early 1860's
re expensive and occupied consid-
able manpower.

For another, local support was not
animous. Although the Humboldt
mes continued to agitate for a road
the Bay area, it got little support
neighboring Mendocino County. In
election here in 1868 a measure to
ovide for a connection through the
unty to its neighbors on the north
d south was defeated 1,038 to 134.
e lumbermen did not want to pay
a road because they used the sea.
e stockmen did not want settlers
ing their range.

World's Most Difficult Terrain

Many people doubted an adequate
ad could ever be built through the
utal terrain drained by the Eel, and
ne were still saying it in the first
cades of this century. Undoubtedly,
ad construction in Mendocino,
umboldt, and Del Norte Counties
nks high among the world's most
fficult roadbuilding terrains, because
heavy rainfall, rivers that rise 60
to 100 feet almost overnight, nearly
sheer slopes, and unstable foundations
that are constantly sliding. There is
a story of one section of the North-
western Pacific Railroad in the Eel
Canyon where all one winter crews
had to go out each morning and move
the tracks back up hill the several feet
they had slid during the night.

In Marin and southern Sonoma
Counties there was no feeling of
urgency for a road north to Hum-
boldt Bay, but in effect, the elements
of this route were gradually taking
shape as normal settlement and com-
merce developed. General ranching,
dairying, and the provision of fire-
wood for the growing Bay area cities,
were prosperous occupations. Logging
of the redwoods stimulated railroad
construction.

There were three main ports for
seaborne passengers and freight, the
ferry landings at Sausalito and San
Quentin, and small steamer traffic
which wound up Petaluma River at
high tide to landings at that city, giv-
ing northbound passengers and cargo
a 30-mile advantage over Sausalito.
The northern side of the Golden Gate
to which the bridge is now anchored
was then only a windswept, unin-
habited promontory.

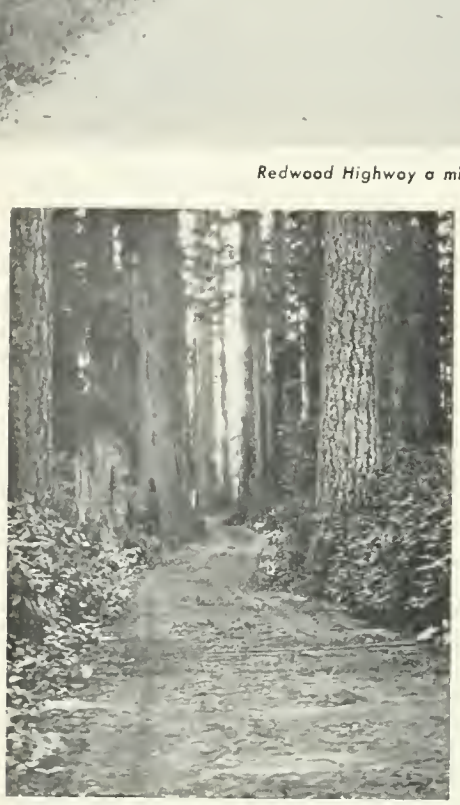
Railroad Reaches Cloverdale

As the towns of Santa Rosa, Ukiah,
and Willits increased and prospered,
the roads connecting them to the Bay
were improved. The railroad, also,
slowly thrust northward, each suc-
ceeding terminus a jumping-off point.
Started in 1869, by 1872 it had reached
Cloverdale, but it was 1914 before it
reached Eureka.

In Eureka the Humboldt *Times*
continued to call for a road to the
Bay. In July 1865 the Eel River and
Mattole Plank and Turnpike Co., Inc.,
was formed. This was superseded
shortly by the Petrolia and Center-
ville Plank and Turnpike Co., with
an advertised capital of $30,000. Con-
struction started in 1869, and by 1871
a daily stage was running from Eureka
to Petrolia via Table Bluff, Ferndale,
and Centerville.

ABOVE: High water on the Salt River, January 16, 1909, near Ferndale, Humboldt County, on coast route. The road between Eureka and Ferndale is part of State Sign Route 1. (Courtesy of Andrew Genzoli, Eureka.) BELOW: Because lumber was cheap and other materials involved expensive shipment and haulage, most of the early bridges in the north coast counties were of wood. This typical bridge of that day, on the present Redwood Highway alignment, was built by a county. It has been replaced long ago, of course.

Redwood Highway a mile south of Willits in 1900's.



ABOVE: Section of plank road on Redwood Highway in Del Norte County a few miles south of Crescent City around 1915. BELOW: Devil's Knee on old highway in 1911 where it dropped from Mail Ridge Route down to McCann on Main Fork of the Eel.

This road was gradually extended up the Mattole to a point near its source, then it turned inland to Briceland, and crossed the South Fork of the Eel close to Garberville. From Garberville it climbed straight up the mountainside to join the Alderpoint Road, which was being extended southward.

In 1911 Jack London djd a magazine story on a trip from the Bay to Eureka which he and Charmian took in a "light Studebaker trap" with a three-horse team. They followed the usual route north to Willits, then crossed over to Fort Bragg, continued north through Usal, then inland to the Eel River via Briceland, north to Eureka, and eventually to Crescent City, where they were lionized.

When the Legislature authorized county supervisors to issue road bonds in 1874, Humboldt County sold $60,000 worth. The money was partly for the Petrolia-Briceland road, but most of it was earmarked for a more direct route through Kneeland Prairie. This road headed almost due south to cross the Van Duzen at Bridgeville, and by 1875 had reached Blocksburg, 70 miles from Eureka.

The next year they reached Alderpoint, where the main fork of the Eel had to be forded. Later a water power ferry was installed here. Chinese labor was hired in 1876, and in two more years connection was made with the Bell Springs Road at Dark Canyon. This road dropped down a precipitous grade to Twin Rocks, from whence the route continued southward over much the same alignment now followed by the Redwood Highway.

Mail Ridge Road

Somewhat later a branch of this route was built along the top of the ridge (later getting the name "Mail Ridge Road"). This alternate was shorter but it dropped down the steep slopes in a series of switchbacks and hairpin turns to McCann on the main Eel, frightening many travelers. Another magazine article, written approximately the same time as was Jack London's, tells of following this route by automobile in 1911, and gives a good picture of auto travel in that day.

The party left San Francisco in the afternoon, landed from the ferry at Sausalito, then proceeded at a leisurely pace to Santa Rosa, where they spent the first night. Starting the next morning early, they made the sections from Santa Rosa to Ukiah, and from Ukiah to Willits without incident. From here north, the road worsened rapidly, being very dusty and deeply rutted from teaming.

Intending to stay at the inn at Twin Rocks that night, they pushed on past Laytonville, but darkness caught them negotiating a narrow canyon some distance from their destination. They broke several springs which they had to repair with oak branches, the pan dragged because of the deep ruts, and the narrow road along the edge of the precipitous canyon could be only dimly seen by the light of their oil lamps.

Bell Spring Mountain

They finally made Twin Rocks, and the next morning had to head straight up the side of Bell Spring Mountain, 4,600 feet high. On the way the motor was boiling so badly they had to stop and reset the carburetor. At the top of the grade they headed north along the ridge through Bell Springs, East View House, Harris, Hubbards Station, and Fruitland. At this point they started the plunge down to the Eel River, negotiating among the many curves, two notorious ones called "The Devil's Knee" and "The Devil's Elbow," where it was necessary to back up to make the turn. The authors warned that under no circumstances should the motorist attempt to go farther than Dyerville on the third day of the trip.

At Dyerville they crossed the river
1 the ferry, although the auto stages
inning over the route had high
heels and forded the stream. From
e ferry it was only a half-day run
Eureka over a good gravel road,
ell watered. A comforting observa-
on on the trip was the lack of fear
inced by teams met on the road,
ey being accustomed to the auto
ige.

In 1912 Harvey M. Harper drove
om Arizona to Eureka in a Model T
open a Ford agency there. In later
ars Mrs. Harper told of walking
ongside the car on a particularly
ppery clay section north of Willits,
lding a rope tied to the car, to keep
from sliding sidewise in the creek.
hey made the trip with five children,
cluding a babe in arms, for which
rs. Harper carried a wash tub to
ash out the baby's things each night
hen they camped.

Eureka to Willits in 16 Hours!

Judge Harry W. Falk of Eureka
members his first automobile trip
own to the Bay area in June 1913,
hen they traveled via Bridgeville,
locksburg, and Alderpoint. They left
ureka at 4 a.m., and arrived at Willits
8 o'clock that evening. On another
ip, as late as 1920, when the new
ignment was mostly completed, but
ot paved, he and three healthy young
ompanions left Eureka in a rainstorm
3 a.m. The ruts left by the high-
heeled auto stages were so deep they
oved mud all the way from Scotia
Garberville, with the three young
en spending about half the time
ding, the other half pushing when
e car stuck in the mud. They
ached Cloverdale at two the next
orning.

These roads that the driver of that
y took more or less as a matter of
urse, would be terrifying to most
ivers today, and in today's vehicle,
uch more dangerous. Ignoring the
w clearance of today's car, which
ould cause it immediately to stick
the mud, the driver's visibility and
eering control in the old cars was
r superior to today's low silhouette
odels. These changes in automobile
esign have had a profound effect on
ighway design.

Ferndale Bridge under canstructian in 1911 was largest af its type in the world at that time. Design was cancrete and reinforced-steel shell filled with earth. Each 180-faat arch required pauring af 1,000 tons af cancrete in a nanstap aperatian. Mixers were gasaline engine driven, and wet concrete was transported in dumpcarts an rails. Bridge was built by Pacific Canstructian Campany an bid af $245,967, and contractar later admitted he last abaut $10,000 an jab, but gained a great amaunt af experience. Twa thausand people gathered in rain an November 16, 1911, ta celebrate apening af span ta traffic. Requiring anly minar repairs, bridge still is in use after more than 50 years af Eel River flaads. (Phata courtesy af Andrew Genzali, Eureka.)

(Saurce material included Humboldt Bay Regian, Cay, 1929, Califarnia Historical Assaciatian; History and Business Directary af Humboldt Caunty, Daily Humboldt Standard, 1890; Pack and Saddles and Rolling Wheels, Chase and Helms, Triplicate, 1959; Redwaad Frantier—Wilderness Defiant, Genzali and Martin, 1962; Humboldt County Historical Society Quarterly; California State Engineer Biennial Reports; California Divisian af Highways files in Sacramenta and Eureka; variaus newspaper files.

To these individuals thanks for aid must alsa be extended: Andrew Genzali af Eureka; Stuart Nixan af the Redwaad Empire Assaciatian; Dick Denba and Staff af the Humboldt County Chamber af Commerce; Allan R. Ottley, Miriam T. Meyer, and other staff members af the Califarnia Section, State Library; Miss Clarke and Mr. Ekaas af the Clarke Memarial Museum, Eureka; Judge Harry W. Falk af Eureka; Reverend Don M. Chase af Jackson; members af phatagraphic, reproductian, and audiavisual sections af Headquarters Staff, California Divisian af Highways.)

Eureka by 1910 was a sizable city, despite the fact that majar transport was by sea. Railroad at this time reached abaut ta Laytanville, with stage service ta northern cities from railhead if candition af roads permitted. Virtually all freight came by sea. (Caurtesy af Califarnia Section, State Library.)

San Marcos Pass

Modern Highway Built Through Historic Area

By J. M. Sturgeon, District Construction Engineer

Construction of a modern, safe, easy-to-drive scenic highway in a mountainous recreational area was recently accomplished on State Sign Route 154, known locally as the "San Marcos Pass" Road.

San Marcos Pass dropped into the history books in 1846 when Lt. John C. Frémont, guided by Julian Foxen, a local ranchero, marched over the pass and arrived in Santa Barbara while the Mexican forces waited at Gaviota Gorge, far to the west, ready to blast the cliffs of the lower Gaviota Pass area down on his army's head.

The San Marcos Pass Road was originally constructed by Santa Bar-

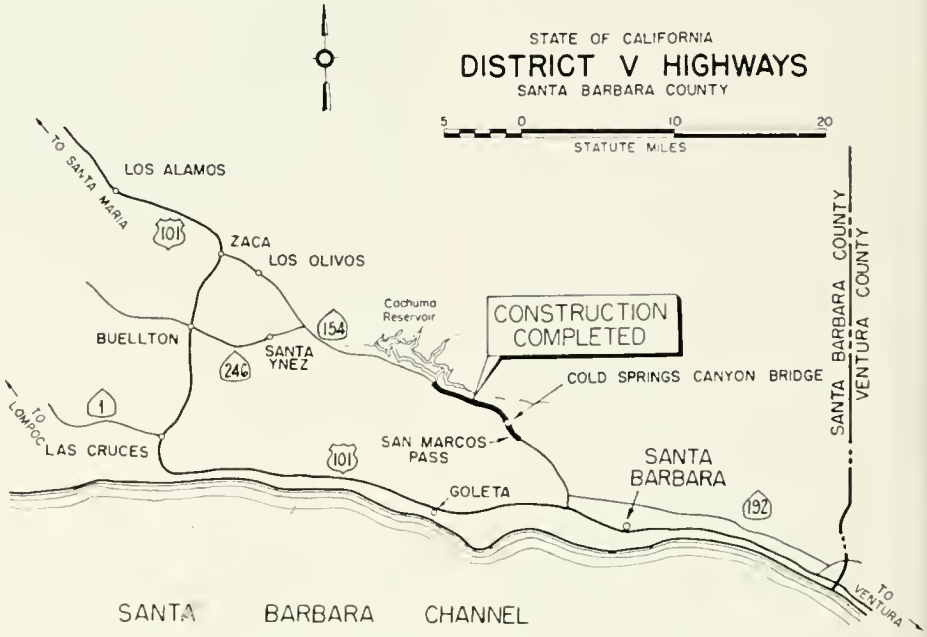


PHOTO BELOW: Looking east across the headwaters of Cachuma Lake near the north end of the new highway.

ara County and the Bureau of Public oads. In 1931 it was taken into the ate highway system.

The most recently completed high- ay reconstruction project in Santa arbara County is in this historic and cenic area. Coxco Joint Venture has nished a realignment contract from ne crest of San Marcos Pass to the oor of the Santa Ynez Valley.

Scenic Area

Though almost the entire alignment f the highway between Santa Bar- ara and its junction with Highway 01 at the old railroad stop at Zaca rovides scenery galore, the recently ompleted stretch provides the most ramatic. As the crest of the pass is pproached from the south, the high- ay passes through an area of huge ock outcroppings. Just after passing ver the crest, the new alignment pro- ides a series of vistas over the upper anta Ynez Valley to the mountains f the Los Padres National Forest and he San Rafael primitive area, location f the Condor Sanctuary, where these are birds can be seen but not olested.

As the road drops down the hills on steady grade, it transitions from a our-lane section to a two-lane section t the new 1,230-foot-long Cold Springs Canyon steel arch bridge, also ecently completed under a separate ontract. Past the Cold Springs arch he highway continues its steady de- cent to the floor of the valley. On he way it touches Paradise Road, the ain access to the camping and recre- tional areas in Los Padres National Forest in southern Santa Barbara County. With several last sweeps that present views of the upper reaches of Lake Cachuma, the alignment ties into existing State Route 154 which was realigned in 1951 when Cachuma Dam was constructed, to replace an older ection that was to be covered by ris- ng waters as the lake formed behind he dam.

Road Serves Homes

As Santa Barbara grew, more and more people moved up into hillside homes that offered spectacular views of coastal Santa Barbara County, the city of Santa Barbara, the ocean, and

Summer traffic on the old route at Cold Springs Canyon Inn.

Vacation traffic on the old road leaving Cachuma Lake and headed for Santa Barbara.

Looking south along the new highway from the floor of the Santa Ynez Valley.

The Paradise Road junction with the new highway looking north up the Santa Ynez Valley.

the Channel Islands offshore. The San Marcos Pass Road was inevitably the main access facility for much of this development.

Also, as Santa Barbara and the general vicinity became more and more widely known as a recreational area, this road became more and more heavily used as a direct route to the Los Padres National Forest campgrounds, fishing sites, and hunting areas.

With the construction of this dam and the creation of Lake Cachuma behind it, a tremendous new recreational attraction was created. Boating, camping, and fishing enthusiasts swarmed into the valley for vacations and traffic soared in five years beyond the 20-year predictions that had previously been made.

And always, for passenger cars, the road has had the advantage of being a scenic yet shorter route than the coast highway, US 101, between Santa Barbara and towns to the north. With this latest project completed, the coast road, US 101, is almost 12 miles longer.

(This latter advantage was, for many years, however, a distance advantage only, not one of time. The narrow and twisting alignment and almost complete lack of safe passing locations kept traffic to the 25 to 35 miles per hour range for much of the distance.)

Last Hazardous Section

By the time the dam was complete, the necessary realignment around the developing lake and reconstruction projects on the coastal side of the Santa Ynez Range had left one seven-mile stretch of narrow twisting road between the crest of San Marcos Pass and the floor of the Santa Ynez Valley as the only high-hazard stretch between Santa Barbara and the towns of Solvang and Los Olivos. This seven-mile section had 62 curves with radii of less than 600 feet. Thirty-five of these had radii of 200 feet or less. Six had radii of 100 feet or less.

Initial studies showed that the most desirable location for a realignment was near the existing road though generally uphill from the lower portions of the existing route. One draw-

k was the necessity for construct- a long horseshoe curve around d Springs Canyon which, at best, uld have to be built on a far too rt radius curve, somewhere be- en 300 and 600 feet. The solution sen was to construct the arch dge across Cold Springs Canyon. this way, the best sections of two erent possible alignments could be d and a net overall economy could realized.

t was also decided to split the re- struction into two projects: one the main roadwork, drainage, and ing; and one contract for the Cold ings Bridge itself. (See *California ghways and Public Works*, Sep- ber-October 1963.)

Bids for the road project were ned on June 6, 1962, and Coxco nt Venture of Stanton was the low der at $3,694,348. The contract s approved on June 29, 1962, with workings days allowed for com- tion. Weather nonworking days ended the allowable contract time to April 30, 1964. However, work was actually completed and the contract accepted by the Director of Public Works on February 28, 1964.

Forest Fire Danger

Weather nonworking days on this project had a somewhat different definition than the usual "stormy weather" connotation. Because so much of the job was located in an area of national forest where forest fires were a matter of overriding concern, the special provisions for the project provided that the contractor could not work, and would not be charged a working day, on any day when the fire danger reached a burning index of 33. Above a burning index of 19, no welding or blasting was permitted.

The cooperation between the United States Forest Service and contractor's forces was such that no fire incidents occurred, even though much of the project ran through "head-high" chaparral bushes which, in dry weather, presented an extreme fire hazard.

In view of the fire hazards on the project, no burning of brush or trees was permitted under the terms of the contract. Instead, the contractor used a mechanical chipper to dispose of all trees and brush under four inches in diameter. The larger trees were disposed of to a local rancher.

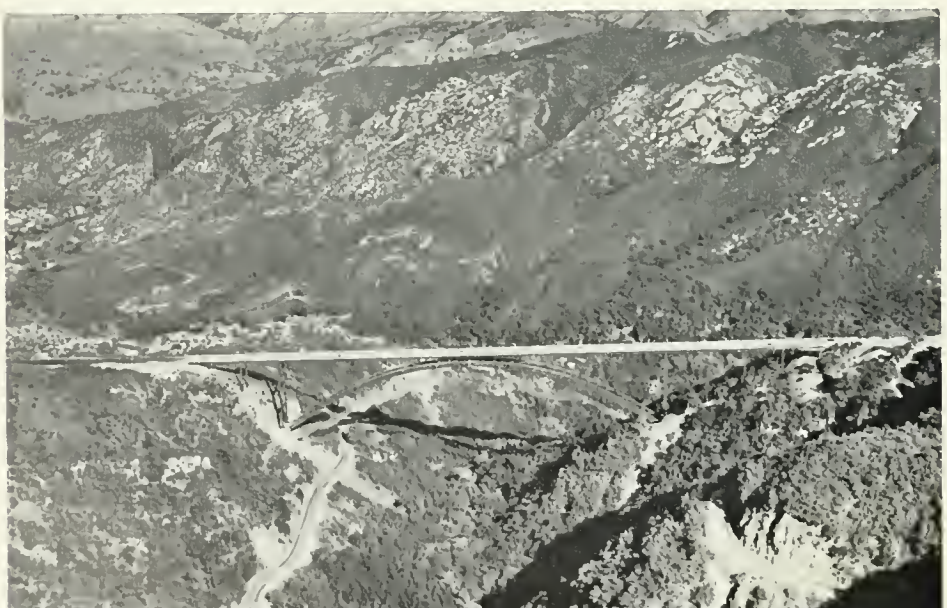
Clearing, grubbing and earthwork operations started near the center of the project. An unusual amount of development and pioneering work was needed to get access to the work areas in the upper part of the job. This decision to begin at the center of the project let the contractor work toward both ends with concentration of equipment and efforts.

Sidehill Construction

Extensive sidehill construction of embankments slowed initial earthwork as did the necessity of installing over 140 culverts for cross drainage. Culverts averaged about 20 per mile and ranged from 18 inches to 114 inches in diameter.

The new Cold Springs Canyon Bridge looking toward the Santa Ynez Mountains in the background.

Closeup of the Cold Springs Canyon Bridge looking toward Santa Barbara and the crest of San Marcos Pass.



A view of the Cold Springs Canyon Bridge when nearly completed, showing the alignment of the old road beneath.

One reinforced concrete pipe has been installed under 185 feet of embankment, representing one of the highest pipe overfills in the state highway system.

Earthwork totaled more than 3,000,000 cubic yards. Initially the job appeared to be "in balance" between excavation and needed embankment quantities. As grading progressed, a minor deficiency of dirt developed; however, this condition was soon reversed by the occurrence of several small slides which resulted in an excess of dirt. Fortunately, a property owner adjacent to the job could make use of the dirt to level and improve some extremely irregular ground on his property. A disposal agreement was obtained and economical disposal of the excess was thus made possible.

Much of the material on the job was a readily compactible shale, but some of the deposits were laced with large boulders two feet in diameter and larger. Many of these were used by the contractor to construct a long looping water energy dissipater of boulders locked in place with air-blown mortar.

Most Unusual Feature

Possibly the most unusual feature of the project was the contractor's solution to the problem of inadequate water supply for the greater length of the job. He elected to take water from Lake Cahuma at the northern end of the project and pump it through an eight-inch waterline to several skid-mounted water tanks spaced along the project. More than six miles of line was installed. While vehicular water rigs were used to handle much of the actual spread of the water for embankment construction, enough taps were placed on the water line itself to permit sprinkler application of water to excavation areas and many structure sites.

The project, at its initial inspection, seemed to present difficult problems on interlocked traffic handling, stage construction, coordination with the concurrent activities of Cold Springs Canyon Bridge, etc. The contractor, Coxco Joint Venture, as the same organization has done on several other projects in this district, proceeded to

ıke the complicated planning and heduling look easy. Prior to submitıg their bid, they had prepared a deled analysis of possible and probable ogress based in part on a seismic ıdy they had made of the entire oject. Their final plan for proceedg with the work, while not a true ıtical path study, was so complete as contain all the data necessary for e creation of one. While inevitably ne chages occurred as the project oceeded, their originally planned ıeduling proved valid throughout e life of the job.

This planning on the part of the ntractor, and most especially the operation exhibited by the conctor in making continuous efforts keep the resident engineer informed the plans, had a two-way benefit. rst, progress was continuous and nflicts reduced to a minimum. cond, the resident engineer was able plan and schedule his inspection efiently. Construction engineering sts on this project, as a result, was ırply lower than the district aver-e on similar projects.

Resident engineer for the State on e project was C. G. Puder, Associate ghway Engineer.

ew Traffic Record et on Bay Bridge

A new traffic record was set on the ı Francisco-Oakland Bay Bridge ring May. On Friday, May 8, a al of 148,137 vehicles crossed the dge in a single day, eclipsing the record of 146,942 vehicles set on day, April 17, 1964.

Recently completed statistics indie that 1964 may be a record-breakyear for Bay Bridge traffic. For first four months of 1964 a total of 936,406 vehicles have crossed the dge, an increase of about 9.7 perıt over the corresponding 1963 riod. The average daily traffic for first quarter of 1964 has been 123,- vehicles; in April the average daily ffic was 128,466 vehicles.

The new relocoted highwoy ot the north end of the project with Cochumo Loke in the bockground. The old rood ties into the new highwoy ot center right.

Cut and fill construction on the new highway near the top of San Marcos Pass. Winding sections of the old alignment can be seen in left background.

Paper Management

Storage, Availability Is Program's Main Goal

By Alfred S. Roxburgh, Chief Management Analyst

Paperwork, the voluminous by-product of more and varied projects, is being handled more efficiently in the Division of Highways, thanks to advances in Paperwork Management. Until recently, the answer to the paperwork problem was to hire more clerks, buy more filing equipment, and rent more space.

Today, the Division of Highways is realizing a substantial monetary and space saving resulting from the implementation of a records management program. Two segments of the program are discussed in this article, and provide an example of the effects of a file reorganization study in District VII, and the results of a pilot map study in District VIII.

In the early 1950's, departments felt the first impact of the increased paperwork load, particularly in the records area. The Service and Supply Department and the Accounting Department were asked to undertake a survey of the storage and use of records in all division offices. It was determined that a records management program would be the first step in controlling the huge volume of accumulating paperwork. Accordingly, the National Records Management Council, in 1957, developed an overall records management program proposal for the division. A long-range program was approved by the State Highway Engineer, and in July 1957 the Management Analysis Section was born.

The first major task of the section was to help carry out the recommendations submitted by the National Records Management Council.* Since that time, file reorganization studies have been completed in Districts I, III, IV, VII, VIII, and XI. The results of the studies, submitted to the districts, are either fully implemented, as in the case of Districts VII and VIII, or are in varying stages of implementation in the other districts. It is planned to complete the studies in Districts II, V, VI, IX, and X during 1964–65.

An organized central index is the key to immediate retrieval in District VIII's central map files.

There are several goals of the records management program:

1. Immediate access to the records —to find a record when it is needed.

2. Elimination of material not frequently used from office areas. This removal leads to storage of necessary but inactive or semiactive records at records centers, and destruction of obsolete records. It also results in space saving.

3. Saving of professional and clerical time.

The first step in the implementation of the file reorganization studies is to reevaluate the existing records disposition schedules. The immediate effect

No wonder the work is enjoyable. This file clerk in District VIII is able to find maps, plans, and tracing effortlessly in the neat, orderly central map files.

* John H. Stanford, "More Highways, Less Paper," *California Highways and Public Works*, Vol. 37, May–June 1958, page 1.

One benefit resulting from the implementotion of District VII's file reorgonization study—an efficient filing system for General Files personnel.

vill be to relieve the office areas of ncreasing volumes of records.

Two of the districts, in which the tudy recommendations have been mplemented with dramatic results, re Districts VII and VIII. A prime xample is the success of the District 'II program. With the growth of the istrict and the need to house various unctions in several locations, a num-er of functional file units developed. This created duplication in filing and ncertainty in finding material.

During the period from February 4 to June 23, 1961, the Management Analysis Section conducted a District 'II files usage survey; the findings 'ere forwarded to the district in Jan-ary 1962 and accepted in March of hat year. As a result, operation and naintenance of almost all departmental les which were previously partly du-licated in General Files, have been aken over at the source of the file nd decentralized. Also, a new systems low has been established with project ecords originating in Advance Plan-ing. The records are now forwarded s the project progresses to Design, Construction and finally into the Records Center.

The benefits in District VII have been:

1. Elimination of unnecessary filing equipment.

2. Establishment of effective records retention and disposition schedules. The amount of material destroyed in 1961 was 335 cubic feet of records. Following the study, the destruction of Records Center material was as follows: 1962, 897 cubic feet; 1963, 560 cubic feet.

3. Use of the Records Center for inactive or semiactive material. In 1962, 497 cubic feet were forwarded to the Records Center; and in 1963, 997 cubic feet were sent to storage.

Mop Study

One of the most pressing problems in the division is that of filing maps, plans, and tracings. With an ever increasing volume of such records, the question of determining *how* they should be retained, *how long* they should be retained, and what mechanics there should be for review and possible clearance of certain categories, has become increasingly complex! To establish certain procedures to accomplish a periodic review, a pilot study was made in District VIII.

As a result of this study, specific procedures were developed which have been incorporated into the district's central map filing system. These methods have been in effect since December 1962, and have provided the mechanics for periodic review (with a potential clearance) of maps, plans, and tracings once they have been transmitted to the Central Files. It is planned that, based on this pilot study, further analysis within the division will be undertaken in the near future.

Other Projects

Forms management, a further step in the effort to streamline the division's paperwork processes, is currently being studied by the Management Analysis Section.

Also, a coordinated library service is being established to provide a centralized index of obtainable reference material for division personnel.

Division management has recognized for some time the constantly increasing need for managing, controlling, and simplifying paperwork. The Management Analysis Section will continue to provide assistance in solving this and other administrative and management problems by consultation or study, looking toward sensible solutions which will assist the Division of Highways to improve operations and increase output.

Freeway Fatalities

Survey Shows Freeways Are Still Twice as Safe as Other Highways

In 1961 and 1962, 26.1 billion miles were driven on California freeways, a distance equal to 140 round trips to the sun. Had this travel taken place on conventional roads and streets, 1,630 persons would have died. As it really happened, there were 802 persons killed. To highway engineers and others concerned with safety, this is 802 too many.

Almost all of the fatal accidents, reported in a study by Roger T. Johnson of the Division of Highways Traffic Department, might have been avoided. How? By safer public driving and pedestrian behavior.

It has been established that freeways are much safer than all other highways and roads. (See "Freeways Are Safer Highways," by J. C. Womack, *California Highways and Public Works*, July–August 1963.) It is also clear that statistics, studied and applied by design engineers, can be used to make freeways even safer in the future. But while the highway engineer can make it difficult for the motorist to have an accident, he cannot make it impossible. The needlessness of the deaths incurred is substantiated by the major findings of Johnson's report which are summarized in this article:

Signs prohibiting pedestrians and cyclists are posted to protect the individual's own safety.

Freeways are unquestionably the safest known way of automobile travel, but they do have, by their nature, fixed objects which can be turned into hazards by the inattentive motorist.

Freeways do prevent deaths. Projections indicate that more than 2,000 fatalities have been avoided since 1949 through the use of freeways instead of conventional highways. As more miles of freeways are completed and opened to traffic, the possibilities for accidents should decrease. Thus, as new stretches of freeway—396 miles opened to traffic in 1962 and 1963—become available, the motorist can protect his own safety by choosing to drive on them instead of on conventional highways.

Table I shows the significance of freeway driving: For a given amount of travel, less than one-half as many people are killed as on other roads and streets.

Although the freeway fatal-accident rate rose from 2.29 (per 100 MVM) in 1961 to 2.71 in 1962, it appears that this is mainly a matter of a cyclic variation in the long-term downward trend. This appraisal has been verified by an analysis of the 10 sections, totaling 175 miles, which accounted for 90 percent of the 1962 statewide increase in fatal accidents.

Surprisingly enough, the total accident rate (fatal and nonfatal) on the 175 miles reviewed in the study rose only slightly. Engineers point out that there is a very fine dividing line between a serious injury accident and a fatal one, and that there were more people who crossed that thin line in 1962 than in 1961. For instance, there were 70 more fatal accidents on these 10 sections in 1962 (as compared with 1961). If these additional fatal accidents on the 175 miles of routes had not occurred, the statewide rate would not have risen.

The motorist needs insight into accident prevention. A breakdown of the most prevalent types of tragedy is given in Table II. It shows precisely where the most common dangers are:

Note that one-half of all freeway fatal accidents are *single-vehicle* accidents in which the driver usually has no one to blame but himself. Nearly one-third of all fatalities on freeways involve hitting fixed objects. These single-vehicle fixed-object accidents pose a dilemma because the safety of freeways evolves from the elimination of conflicting traffic. And yet the structures which make it possible to do away with grade intersections — overcrossings and undercrossings — necessitate supports which, in some cases, become fixed-object hazards. Freeway design studies may be able to provide some answers to this problem but it is still the motorist's responsibility to steer his car down the road instead of off to one side into one of these "objects."

Median barriers are not without quandaries too. Although they are successful in preventing cross-median head-on collisions on freeways, they may also provide another "fixed object" target. The effectiveness of median protection in cross-median prevention, however, has led to a program, begun in 1959, to construct barriers on all state freeways having a traffic volume of 60,000 or more vehicles per day. Additional barriers will be constructed on other freeways as they reach this traffic volume, and on new freeways when the anticipated volume within two years of construction will be 60,000 vehicles per day.

Fatal accident reduction resulting from median barrier installation is cited in Table III.

TABLE III

Year	*Percentage cross-median fatal accidents*
1958 (before barriers)	19.0
1960 (after barriers)	10.9
1962	8.7

TABLE I

	1961–1962 Accidents per million vehicle-miles	*1961–1962 Fatalities per 100 million vehicle-miles*
Freeways	1.43	3.07
All other roads and streets	4.21	5.77
Rural state highways other than freeways	2.47	9.17

Rear-end accidents account for only 19 percent of all *fatal* freeway accidents. This is in contrast to nonfatal accidents of the same type, which account for 60 percent of the nonfatal total. Fifty percent of the 123 rear-

TABLE II

NUMBER AND TYPE OF FATAL ACCIDENTS ON CALIFORNIA FREEWAYS

Type of accident	Fatalities per fatal accident (1961 and 1962)	Number (1961 and 1962)		Percent (1961 and 1962)		Percent (1960)	
Single vehicle			333		50.5		52.3
Hit fixed object	1.21	204		30.9		31.0	
Did not hit fixed object	1.07	129		19.6		21.3	
Pedestrian			84		12.7		14.4
Walkers	1.02	57		8.6		10.5	
Dismounted vehicle occupants	1.04	27		4.1		3.9	
Head-on collisions			104		15.8		16.7
Driving on wrong side of median	1.54	36		5.5		5.8	
Crossed median	1.68	68		10.3		10.9	
Overtaking and sideswipe			139		21.0		16.6
Rear-end	1.36	123		18.6			
Sideswipe	1.14	16		2.4			
Total	1.25		660		100.0		100.0

TABLE IV

FATAL PEDESTRIAN ACCIDENTS

California Freeways, 1961 and 1962

Location of pedestrians when struck	Number of pedestrian accidents	Percent
Traveled way	64	76
Shoulder	12	15
Ramp	6	7
Ramp shoulder	1	1
Unknown	1	1
Total	84	100

TABLE V

AGE OF FREEWAY DRIVERS

California Freeways, 1961 and 1962

Age	Percent of total		
	Fatal accidents	Total accidents	Licensed drivers
14	0.0	0.1	0.0
14–18	5.5	6.8	4.4
19–23	*19.8*	*10.6*	*7.9*
24–28	15.1	15.3	11.3
29–33	8.9	14.1	12.7
34–38	11.4	13.3	13.5
39–48	19.0	20.3	22.6
49–58	12.2	12.1	15.1
59–68	5.2	5.7	8.6
69+	2.9	1.7	3.9
	100.0	100.0	100.0

end fatal accidents involved trucks, even though only 6 to 8 percent of the traffic on freeways consists of trucks, attesting to the need for motorists to be alert.

An analysis of the types of rear-end fatalities provides other tips for the driver to note, especially when sustained grades are involved. Thirty-seven fatal accidents were caused by a car running into the back of a truck. In 22 rear-end fatal accidents, a truck ran into the back of an automobile. Besides keeping alert, the motorist should maintain a proper distance between his automobile and slow-moving vehicles.

The pedestrian on or near the freeway must exercise extreme caution. In 1961 and 1962, there were 84 fatal pedestrian accidents, accounting for 13 percent of all freeway fatalities. When a freeway is so posted, pedestrians are prohibited, although an emergency may make anyone a pedestrian upon occasion. Pedestrians should also stay clear of freeway ramps. A breakdown of the types of fatal accidents which happen to pedestrians on freeways is given in Table IV.

A study of all freeway pedestrian accidents is underway to determine what measures the Division of Highways can take to reduce these accidents.

To the pedestrian, the moral should be obvious: Stay away from the pavement; if you must be on the shoulder, put as much distance between you and the roadway as possible; and, if you can, await the arrival of a police officer for aid.

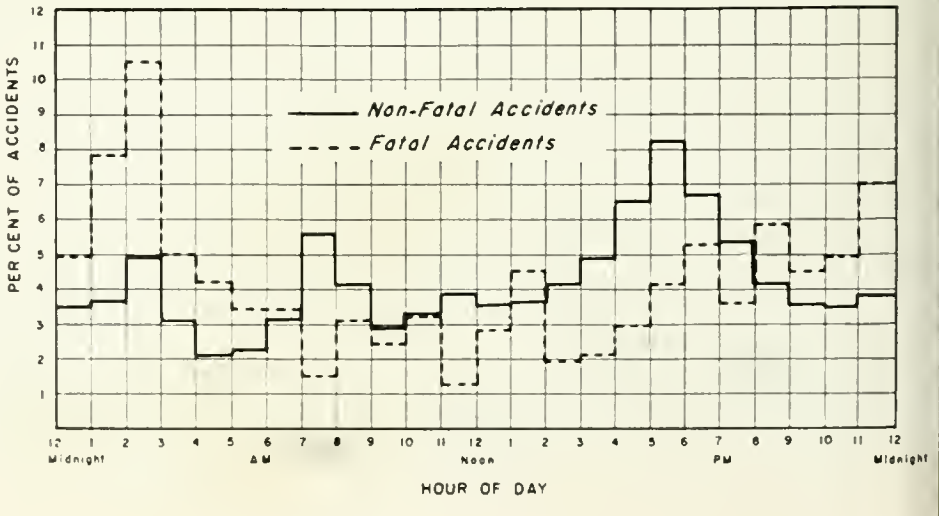
Ramps and ramp maneuvers were involved in 11.5 percent of freeway fatal accidents. Of these, 75 percent were *single-vehicle* accidents, stressing the necessity for the driver to approach a ramp cautiously, and again to watch for fixed objects which are needed for signing, lighting, and other essential purposes.

As has long been known, drivers between 19 and 23 years of age contribute disproportionately to both fatal accidents and total accidents. (See Table V.) Drivers in this age group were involved in 20 percent of the freeway fatal accidents while comprising only 8 percent of all licensed drivers. In fact, traffic accidents are the leading cause of death among all persons from age 5 to 31.

The distribution of freeway fatal accidents by hour of day does not change much from year to year. About 30 percent of the fatal accidents occur between 11 p.m. and 3 a.m., but only

... Continued on page 23

HOUR OF OCCURRENCE
FATAL AND NON-FATAL ACCIDENTS
CALIFORNIA FREEWAYS
1961 and 1962



New 'Standard Specs' Edition Is Issued

A new edition of the Standard Specifications of the California Division of Highways, dated July 1964 has been issued.

It supersedes the previous edition dated January 1960 and will be effective for all contracts awarded after July 1, 1964.

Copies of the new Standard Specifications may be purchased from the Department of General Services, Office of Procurement, Documents Section, P.O. Box 1612, Sacramento, California 95807, at a price of $1.50 plus 6 cents sales tax for a paper-covered copy. Remittance should accompany orders. The sales tax does not apply on orders originating outside California.

This new edition is the result of a continuing recheck and revision by many members of the staff of the Division of Highways and incorporates the latest ideas and developments in highway design and construction practices.

Significant changes have been made in 62 of the 94 sections making up the book, ranging from revisions of gradings for rock slope protection to minor changes in the definitions of "culvert" and "roadbed."

A new section has been added entitled "Relief of Bidders" calling attention to the State Contract Act which provides the bidder relief from mistake after bids are opened.

The section on "Responsibility for Damage" has been rewritten.

Other changes provide for supplemental time limits on designated portions of the work under the "Time of Completion" section and the addition of labor disputes as a reason for an extension of time under "Liquidated Damages."

A few other examples of the many changes, chosen at random:

The "Slopes" section has been revised to provide a larger tolerance when embankments are constructed of large rock.

New sections on "Deficiency Material" and "Pervious Backfill Material" have been added.

Under "Aggregate Bases," the standard grading size of material has been changed from a 1½-inch maximum to a ¾-inch maximum.

Expansion joint spacing for curbs and sidewalks has been increased from 20 to 60 feet.

A new section on pumping plant equipment has been added.

Fifty percent of rear-end fatal accidents on freeways involve trucks. Sustained mountain grades usually mean slow-moving large vehicles.

Freeway Fatalities

Continued from page 22 . . .

about 5 percent of travel occurs during these hours. The *severity* of accidents is known to be considerably higher during hours of darkness, as suggested by the accompanying "hour of occurrence" chart.

Of the drivers who caused freeway fatal accidents, 36 percent had been drinking, 17 percent had physical shortcomings (fatigue, sleepiness, illness, poor eyesight, etc.), and 7 percent were driving defective vehicles. In addition, some drivers were emotionally upset, and, while the degree of psychic disturbance is not readily measurable, it was considered to be a factor in fatal accidents. An emotionally upset driver will often times take chances and make errors he would not make in a better frame of mind.

After analyzing the 660 freeway fatal accidents, it became apparent that driver errors and physical shortcomings play an important role in accidents which result in death. Drivers get behind the wheel when they are physically incapable of operating a motor vehicle safely. They make errors which they cannot visualize themselves making, and they use vehicles which are not safe for the road.

Fatal accidents involve actions which are irrational to an extent not observed in nonfatal accidents.

Witness, for example, an accident report excerpted from the freeway fatality study:

"Pedestrian, who lived in neighborhood, was crawling on hands and knees across the freeway in the dark. The driver of Vehicle Number One saw the pedestrian just before impact."

Bay Area Report—1964

By J. P. Sinclair, District Engineer

Planning the "freeways of the future" is probably the single most impressive development applying to highway construction in the San Francisco Bay area that has come to light in the last year.

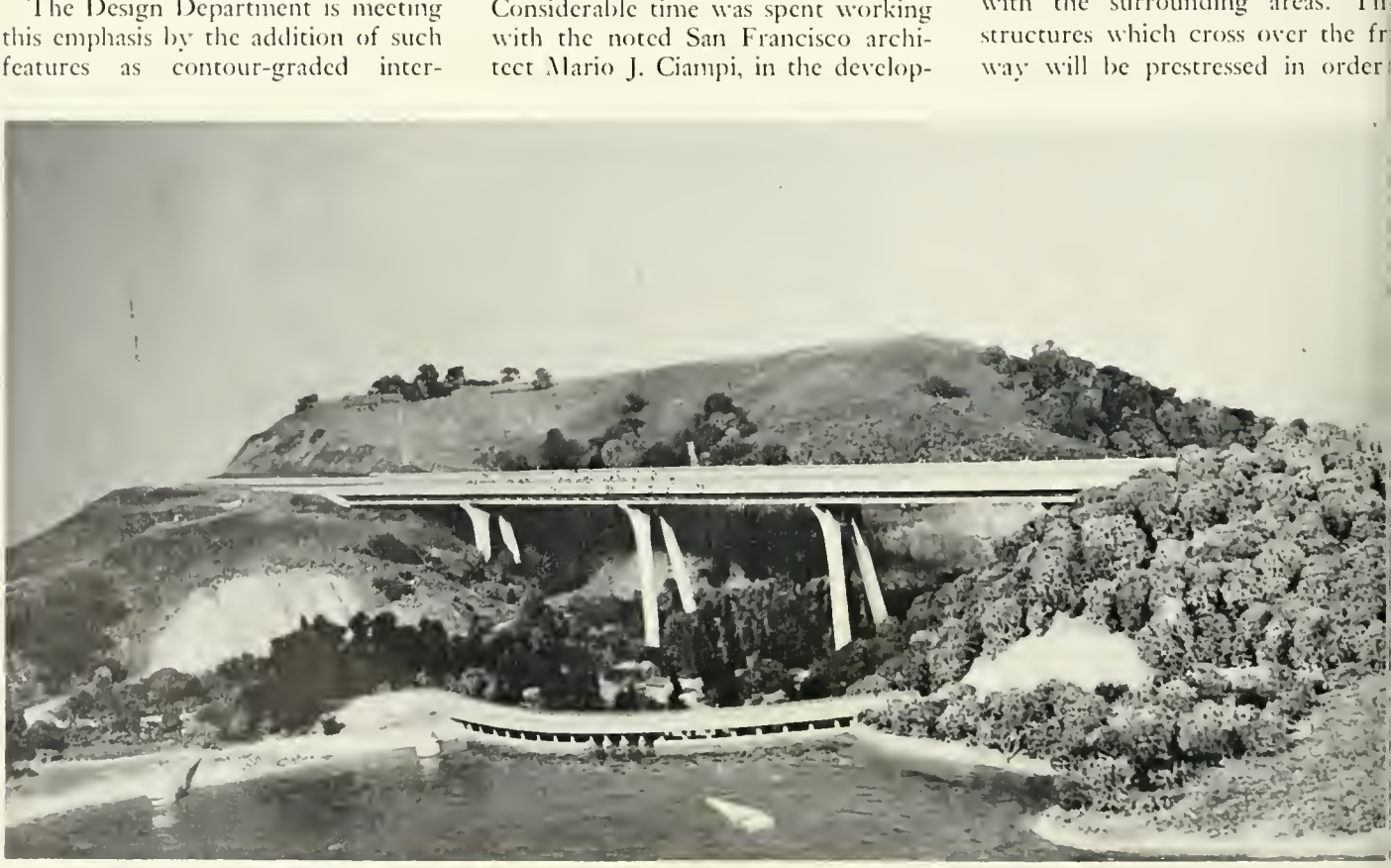
Increased emphasis is being placed on efforts to make freeways and structures more aesthetically pleasing and to blend the highways into the landscapes of the areas through which they pass, with due consideration given to the protection of both social and economic values by both state and local agencies.

The Design Department is meeting this emphasis by the addition of such features as contour-graded interchanges and increased attention to the impact of drainage and other structures on the appearance of the highways.

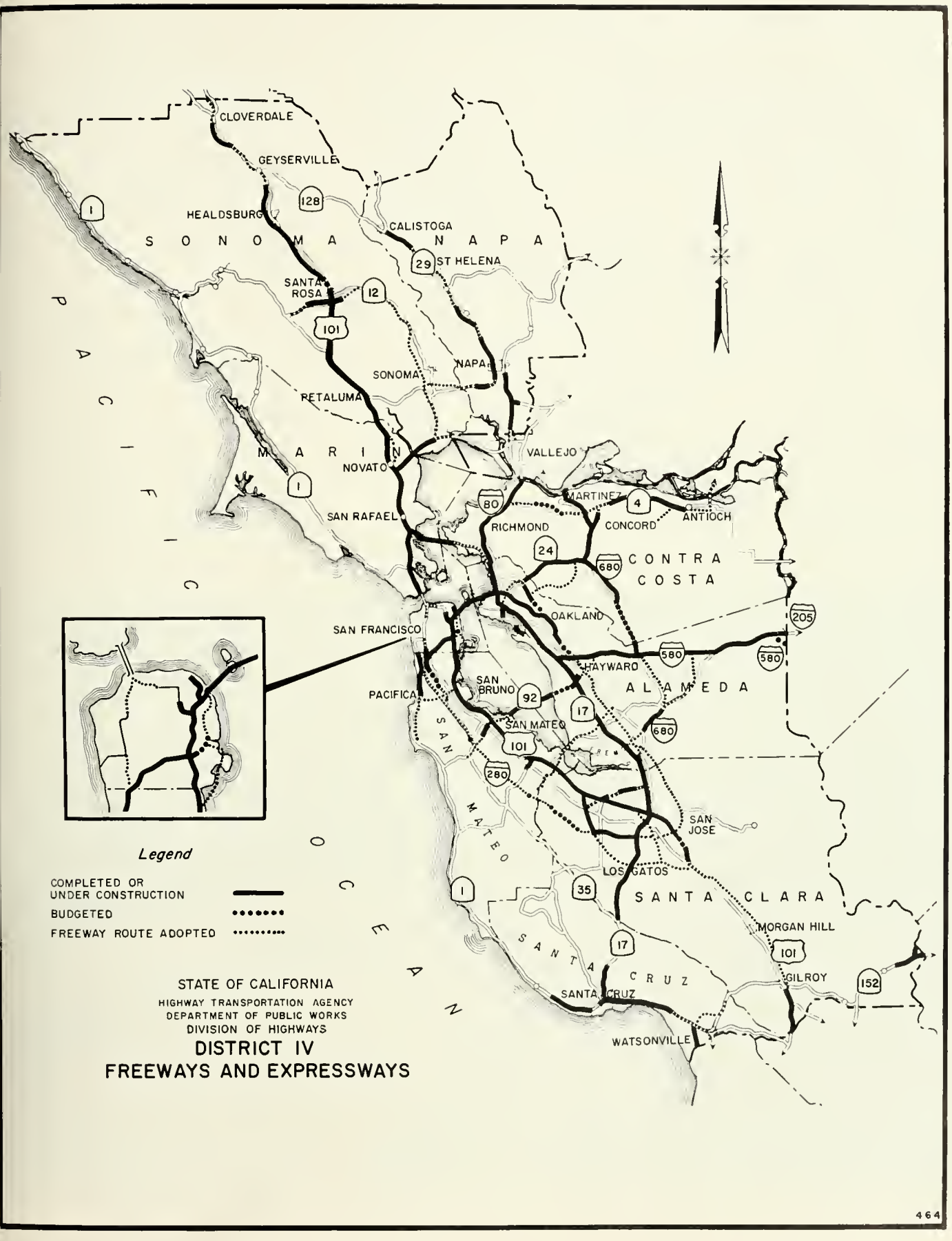
Editor's Note: This report was prepared shortly before Mr. Sinclair's death on May 24, 1964. For a summary of his career, see p. 69.

The Division of Highways has retained several prominent consulting architects and has worked with them in the development of pleasing aesthetic designs for sections of freeway and for structures in certain locations.

One such location is the future Interstate 280 (Junipero Serra) Freeway. Considerable time was spent working with the noted San Francisco architect Mario J. Ciampi, in the development of designs for the structu in the first contract of this freew By combining some aspects of aesthetic treatment proposed by architect with economic structural quirements, a design has resul which will bring many new and pl ing features to the more than structures which will be built on scenic freeway. This new look include such items as curved edges the bridge superstructure to create illusion of thinness, variety in fo and appearance of the support piers, and the extension of the bri railing to dispense with the need metal guard railing at the bridge er The liberal use of curved and obli surfaces will soften the lines and able the structures to better bl with the surrounding areas. Th structures which cross over the fr way will be prestressed in order



This is a Bridge Department model of the proposed eight-lane bridge over San Mateo Creek on Interstate Route 280. Note the graceful concrete col supporting the slim steel roadway which blends into the surrounding area. Crystal Springs Dam is shown in the foreground.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HIGHWAY TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
DISTRICT IV
FREEWAYS AND EXPRESSWAYS
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reduce the thickness of the overhead structure and provide a thinner, more pleasing profile.

Throughout the development of the plans for this freeway, the division has had the cooperation of the Peninsula Highway Policy Committee, an advisory group of planners and other officials and civic leaders from the area the freeway traverses. The committee has been shown the proposed designs, sketches, and some models of the work as it progressed. In March they reviewed the plans and several models of an eight-lane bridge over San Mateo Creek near the Crystal Springs Dam. This will be the major structure on this stretch of Interstate 280.

Parallel Bridges

The parallel bridges at San Mateo Creek will be a monumental pair of structures. Over 1,800 feet long and more than 250 feet above the streambed in the center, their very size required a great deal of study to assure a design which would be a credit to its surroundings. Four gracefully arched piers will support the twin structures. The superstructure will be of steel welded girders with a novel sloping support plate along each side to provide an interesting light and shadow effect masking the steel girders.

In the City of San Francisco a public hearing was held on April 6, 1964, for the presentation of a number of alternative routes and plans for carrying traffic from the present terminus of the Central Freeway at Franklin and Octavia Streets to the southern approaches to the Golden Gate Bridge.

This presentation resulted from a request by the Board of Supervisors of the City and County of San Francisco to the Division of Highways requesting the State to study alternative locations for a Crosstown Tunnel and a Panhandle Parkway. The material presented at the public hearing was based on a comprehensive technical report prepared in conjunction with a coordinating committee of city officials—the directors of planning and of public works and the general manager of the park and recreation department—and in association with San Francisco Landscape Architect Lawrence Halprin and Associates. It represents a "new look" in urban trafficway design in that all facets of urban life have been considered—the resident as well as the motorist, the social and economic impact as well as the safe and efficient movement of motor vehicles.

Hearing Is Held

The California Highway Commission held a public hearing in San Francisco on May 21, looking toward adoption of a route location.

Placing increasing pressure on the urgency of planning the "freeways of the future" is the population explosion. California has become the largest state in the union, in terms of population, with almost 18,000,000 inhabitants. Of that number, about 4,096,700 lived in the Bay area as of January 1, 1964. In a speech of the Bay Area Council Conference of the Future of the Bay Area on February 29, 1964, Dr. Weldon B. Gibson, Executive Vice President of the Stanford Research Institute, stated that the population of the Bay area had increased 46 percent between 1951 and 1963. According to current estimates of the demographers, the Bay area population will have increased to some 6,500,000 people by 1980.

Stanford Research Institute points out that the San Francisco Bay area will enjoy a continuing economic boom in future years—sparked by missile and electronic work for the space agencies, increased employment in defense and the metal-using industries, greatly expanded primary steel production capacity, government employment (particularly in those areas concerned with higher education), and in central offices of finance and insurance companies, wholesale distributors, and similar businesses.

The San Francisco Bay area has the ability to attract top scientific and administrative personnel since it is already one of the five major research and development centers of the Space Age in the nation and is, in addition, the home of 14 Nobel Prize winners in the physical sciences—mostly teaching at the great local universities.

In addition, it has the benefits of year-round temperate climate, attractive housing, good schools, many social and cultural amenities, and a great variety of recreational activities within reasonable distances.

One more significant projection that has been carefully considered by the freeway planners is the phenomenal increase in motor vehicle registration. For example, in San Francisco some 750,000 persons now own more than 300,000 automobiles. By 1985, it is predicted that 800,000 San Franciscans will operate nearly 500,000 motor vehicles.

San Francisco's streets and highways handled 1,300,000 automobile trips each day in 1960. By 1985, the city's streets will handle a predicted 2,000,000 vehicle trips per day, exclusive of almost 500,000 transit passenger trips.

The estimates for the mushrooming growth of travel are the same all over the Bay area. There are now probably some 7,000,000 vehicle trips per day taken by residents of the Bay area. It is predicted that by 1975 there will be in the neighborhood of 11,000,000 daily vehicle trips taken in the same area.

Another Study

Another Stanford Research Institute study reports that more than 27 percent of the households in the San Francisco Bay area had two or more automobiles in 1960. According to the estimates for increased motor vehicle registration, that figure should have increased substantially by 1980, when the California freeway and expressway system is scheduled to be substantially completed.

Use of the highways for travel to recreational and vacation sites has increased tremendously in recent years. This will be another major source of traffic in coming years. In fact, some 3,520,000 of the 11,000,000 daily vehicle trips taken in 1975 will be for social and recreational purposes.

By 1980, it is anticipated that some 3,700,000 registered motor vehicles, owned by about 6,500,000 people, will be using the 1,300 miles of freeway and expressway, which are expected to carry 59 percent of the total traffic in the San Francisco Bay area.

Following is a county-by-county report of progress made in District IV during the last year to attain that goal:

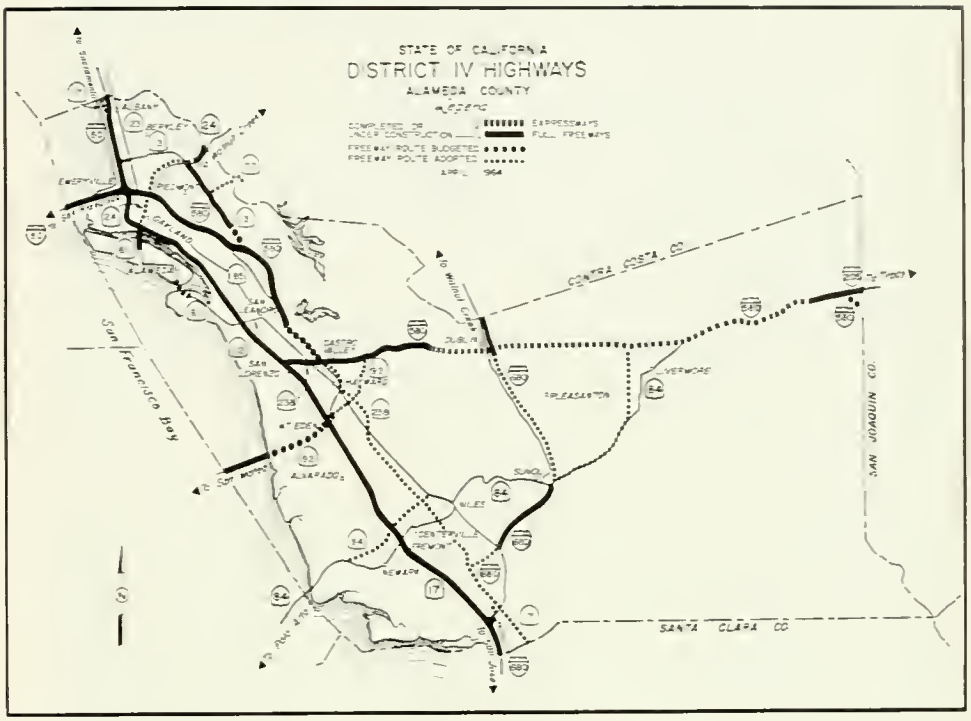
ALAMEDA COUNTY

Impressive progress was made during the past year in highway construction throughout Alameda County as significant sections of brandnew or improved freeway were opened to traffic.

A 3-mile stretch of the Route 580 Freeway on new alignment and a 5.4-mile section of Interstate Route 680 were added to the county's highways, while a 5.6-mile segment of the Nimitz was widened to a full eight lanes between Fallon Street and Hegenberger Road in Oakland.

A big boost to the safety of travel between Alameda and Oakland came with the opening of the Posey Tube to eastbound traffic only, while westbound uses the new Webster Street Tube.

One more significant development in Alameda County came on December 16, 1963, when the new bore of the Caldecott Tunnel excavation was completed. When it is opened to traffic, in September 1964, it will help



Contractor's equipment touches up a portion of the three-mile section of Interstate Route 580 between Park Boulevard and Buell Street in Oakland in preparation for its opening to traffic on April 28, 1964.

relieve the bottleneck in travel between the growing communities of the north East Bay and the metropolitan areas of Oakland and San Francisco.

Interstate Route 580

The first of three contiguous projects which, when the final one is completed in November 1965, will allow the use of almost 14 miles of eight-lane divided freeway between the Bay Bridge distribution structure and Sybil Avenue in San Leandro, opened to traffic on April 28, 1964. The freeway replaces the old section of US 50 along MacArthur and Foothill Boulevards. The 3.8-mile section between the distribution structure and Park Boulevard was opened in 1962.

The newly opened section of the Route 580 Freeway runs for three miles between Park Boulevard and Buell Street. The work included construction of a number of grade separations for cross traffic, several interchanges for access to the freeway, and a pumphouse for drainage. It was done by a joint venture of Stolte, Inc., and Morrison-Knudsen Company, Inc., at a cost of $7,685,000.

Buell to Durant

The second project, a 4.5-mile section of freeway on completely new alignment, generally follows Calaveras Avenue to the north of Mills College and to the west of the Oakland Naval Hospital, known locally as Oak Knoll, and Mountain Boulevard to the west of the Joseph R. Knowland State Park and Arboretum.

This contract, which is approximately 45 percent complete, is being accomplished by Gordon H. Ball, Inc., at a cost of some $12,000,000.

Its most significant feature is the construction of a directional interchange northeast of Mills College to provide freeway-to-freeway service between Routes 580 and 13, the Warren Boulevard Freeway. It also includes rough grading on that portion of 13 north to Carson Street and a number of grade separations and interchanges for the use of local traffic.

Contributions of $150,000 were received from both the City of Oakland and the County of Alameda Joint Highway District Funds, plus an additional $46,000 from the Major City Street Fund of the City of Oakland for this work on Route 13, which will not be usable by traffic, however, until paved on a future contract.

Durant to 173d Avenue

The third project under construction, the two-mile section between the east city limit of Oakland near Durant Avenue and Sybil Avenue in San Leandro, is expected to be open to traffic in August of this year.

Guy F. Atkinson Company is the contractor on this $5,043,000 job. The major interchange on this unit will be at the intersection of the existing MacArthur and Foothill Boulevards at the north end of the project. Other structures include bridges over San Ramon Creek and several grade separations.

Bids were opened on a job to build an 2.9-mile eight-lane freeway on Interstate 580 from Sybil Avenue in San Leandro to 173d Avenue in Castro Valley on June 17, 1964. There is a budget item of $6,000,000 to cover cost of the project.

Castro Valley East

A four-lane facility has been in service for some 10 years between the intersection of Routes 238 and 580 at Castro Valley Junction and 0.7 mile east of Crow Canyon Road. Studies for the proposed widening of this 3.1-mile portion of Interstate 580 were presented at a public hearing on December 12, 1963. Studies for widening the remaining 6.8 miles between Crow Canyon Road and Route 680 also have been completed and were presented at a public hearing in conjunction with a meeting of the board of supervisors in February 1964.

Landscaping

Two contracts for landscaping 3.3 miles of Interstate 580 between the Bay Bridge distribution structure and Park Boulevard have been in progress since mid-1963 by Watkin & Sibbald. The section between Grand Avenue and Park Boulevard was recently completed at a cost of $194,000.

The work included installation of an irrigation system and the planting of 600 trees, 10,000 shrubs, and more than 300,000 Algerian ivy plants for ground cover.

On the remaining project, between Hannah Street and Grand Avenue, planting of 1,000 trees, 10,000 shrubs, and more than 200,000 ivy and ice plant cuttings has been completed and the plant establishment period is underway. An irrigation system was also installed as part of this $180,500 project.

Future landscaping projects on Route 580 include the newly opened section between Park Boulevard and Buell Street for which the sum of $360,000 was included in the 1963–64 construction budget, and the section now under construction from Buell Street in Oakland to Gabriel Court in San Leandro—for which design studies are now in progress.

Interstate Route 680

The first section of Interstate Route 680 to be open to traffic in Alameda County is a 5.4-mile stretch between Route 238 near Mission San Jose and Route 84 at Scott's Corner. This $5,940,000 job, which was built by the Fredrickson & Watson Construction Company, was opened on January 9, 1964.

Structural work included the construction of five interchanges and the widening and reconstruction of bridges over Alameda Creek.

A contract was awarded to a joint venture of Green Construction Company and Winston Brothers Construction Company to build 3.1 miles of six-lane divided freeway on a new north-south alignment on Interstate Route 680 between 0.4 mile south of Interstate 580 and 1 mile north of the Alameda-Contra Costa line near Dublin. The sum of $5,312,000 has been allocated for the project. Work started on March 6, 1964.

Major structural feature of this job is a full cloverleaf interchange at the intersection of Interstate Routes 580 and 680. Interstate 580 will be widened from four to eight lanes within the limits of the interchange. Other structural features include construction of a diamond interchange at Alcosta Boulevard, bridges over the Alamo Canal, and other traffic separation structures.

Design studies are in progress for the 8.7-mile section of Interstate 680 between Route 84 at Scott's Corner and Interstate 580 east of Dublin, as well as the remaining 4.7 miles of In-

terstate 680 in Alameda County between Route 17 at Warm Springs and the junction with Route 238 near Mission Boulevard.

Route 13

The job to build an interchange at Moraga Avenue on the Warren Boulevard Freeway, Route 13, was completed on April 15, 1964.

Dan Caputo Company performed the $1,292,000 job, which will eliminate the last signalized interchange on Route 13 north of Redwood Road and provide structures to carry the freeway over Moraga Avenue and to carry Moraga over one interchange ramp. The sum of $45,000 has been budgeted to landscape this interchange now that construction work has been completed.

Some $1,800,000 has been budgeted for the construction of 1.3 miles of four- and six-lane freeway on Route 13 between Atlas Avenue and Interstate 580 near Calaveras Avenue. This project is expected to be advertised for bid this summer. The rough grading between Interstate 580 and Carson Street, alluded to above, is preliminary to this job.

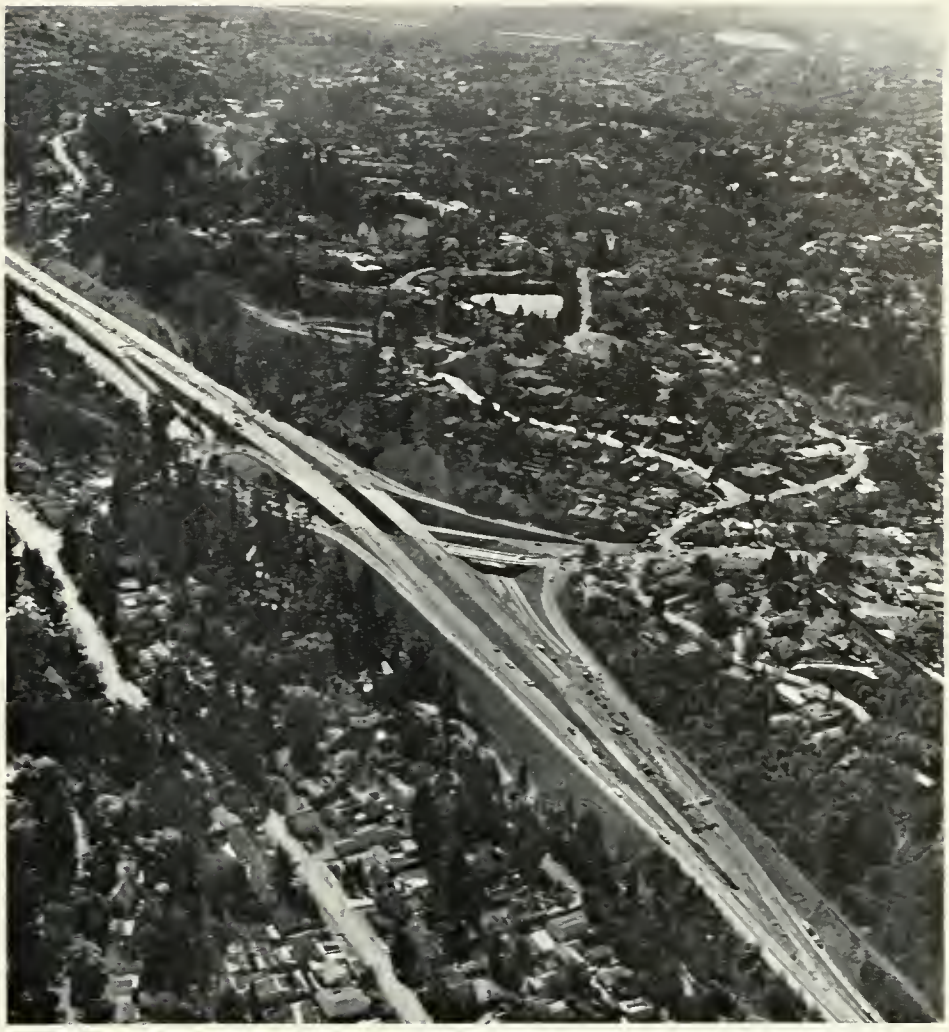
Route 17

Andell, Inc., completed work in March on the additional drainage outfall at the distribution structure east of the Bay Bridge Toll Plaza. This project, to minimize flooding at the distribution structure, cost approximately $43,000.

A $4,441,000 contract to widen 5.6 miles of the Nimitz Freeway between Fallon Street and Hegenberger Road in Oakland, including widening of overheads and modification of interchange ramps within the bounds of the project, was completed on October 1, 1963, by a joint venture of Dan Caputo, Dan Caputo Company, and Cambrian Gateway. Eight lanes are now available for traffic on Route 17 between El Cerrito Overhead and Hegenberger Road.

The 1964-65 budget provides $300,000 for resurfacing the Nimitz Freeway between San Lorenzo Creek in San Leandro and 0.3 mile north of Hegenberger Road.

Design studies have been completed for landscaping the Marina Boulevard interchange, which was reconstructed in 1963, and for the erection of 6.8 miles of median barrier between Jarvis Avenue and Jackson Street on the Nimitz Freeway.



Looking south at the Moraga Avenue Interchange on Warren Boulevard Freeway, Route 13.

Caldecott Tunnel

Approximately 92 percent of the work on the new bore, which lies 150 feet north of the existing Caldecott Tunnel, has been completed. Here is a brief review of significant dates in this tunnel construction:

Holing through small wall plate drifts—January 9, 1963; holing through main arch drift—July 25, 1963; entire excavation completed—December 16, 1963; tunnel lining placed—December 26, 1963; tiling of walls completed—March 11, 1964; roadway paving completed—March 27, 1964; entire paving job, including curbs and gutters, completed—April 2, 1964.

Completion date on this $10,897,000 project, which was undertaken as a joint venture by Connolly-Pacific Company, Grafe-Callahan Construction Company, Brayer Electric Company, and Charles L. Harney, Inc., is September 1964.

The sum of $1,250,000 has been budgeted for the renovation of the existing Caldecott Tunnel as soon as the new bore has been opened to traffic. It is planned to advertise the project in sufficient time before the new tunnel is opened to permit ordering the necessary equipment. This project will include painting, installation of improved ventilation equipment, traffic control systems, and drainage corrections. The existing bores will be closed, two lanes a a time, during renovation.

Route 24

Guy F. Atkinson Company started work on February 26, 1964, on a contract to grade, pave, and provide structures on a 1.26-mile section of eight-lane freeway on Route 24 between 0.4 mile west of Warren Boulevard Freeway and the west portal of the Caldecott Tunnel.

Interesting features of the job include construction of a 260-foot structure to carry Kay Avenue traffic over the freeway and grading of a sizable portion of the right-of-way for the future eight-lane freeway through the rugged canyons of the Berkeley Hills.

The sum of $4,391,000 was allocated for the work, of which approximately $40,000 is being contributed by the City of Oakland. The job is scheduled to be completed in the fall of 1965.

Rapid Transit

Studies are in progress for the redesign of portions of Route 24 to accommodate facilities of the Bay Area Rapid Transit District between south of Route 580 and Golden Gate Avenue in Oakland. A project for the completion of the freeway-to-freeway connector ramps for the Route 24/580 interchange between south of Route 580 and 42d Street is included in a construction program in the next few years.

The rapid transit facilities will be carried in the median between 27th Street and Golden Gate Avenue. Agreements with B.A.R.T.D. have been negotiated and the additional right-of-way requirements for their facilities are being determined.

Route 92

A $3,500,000 project is expected to be advertised this fall for the construction of a three-mile portion of Route 92 between the San Mateo-Hayward Bridge and Hesperian Boulevard.

Design studies for the remainder of Route 92 between Hesperian Boulevard and Interstate 580, including the recently adopted portion in Hayward, are in progress.

Route 84

A contract for the construction of a channelization and signal and lighting modifications on Mission Boulevard at its junction with Route 84 at Niles Canyon Road was completed on January 21, 1964, at a cost of $32,000 by Del Monte Electric Company.

Design studies are underway for the construction of Route 84 to ultimate freeway standards between Dumbarton Road in Newark and Route 238, and for approximately 10 miles of freeway on Route 84 between Route 680 near Sunol and Route 580 near Livermore.

Other Routes

Studies are underway for the ultimate development of Route 238 between Route 61 and the Route 238/580 Interchange at Castro Valley Junction. Design studies are also in progress for the development of Route 238 northerly from Washington Boulevard in Fremont to the same Route 238/580 Interchange.

Planning studies are in progress to determine the future alignment of Route 61 from Route 84 in Newark to south of Alameda. Aerial photography has been procured for this purpose.

The Posey Tube opened to traffic on November 21, 1963, after a $1,110,000 modernization job by Stolte, Inc. The work included revisions to the electrical and mechanical equipment, installation of fluorescent tunnel and new roadway approach lighting, and emergency traffic control systems.

This permitted the use of one-way traffic in each tube—eastbound in the Posey Tube and westbound in the new Webster Street Tube. Design studies are well advanced for landscaping the approaches to the Webster Street and Posey Tubes.

CONTRA COSTA COUNTY

The largest freeway contract ever let in the San Francisco Bay area is now more than three-quarters complete. It is part of the construction on Interstate Route 680, which is planned for completion to full freeway standards for its entire length through Contra Costa County in the next several years. See below for specific details.

Another large contract ($10,897,000) now under construction involves the Caldecott Tunnel, which lies in Contra Costa and Alameda Counties. The tunnel is expected to be open to traffic in September 1964. (See Alameda County for complete details.)

Interstate Route 680

Traffic started using the 1.7-mile section of Interstate Route 680 between Monument Boulevard in Concord and Willow Pass Road on January 6, 1964.

This work performed in conjunction with the construction of 3.8 miles of freeway on Route 242 between Monument Boulevard and Olivera Street, completed Route 680 to full standards between Walnut Creek and Interstate Route 80 in Vallejo, including the Benicia-Martinez Toll Bridge. Structural features included construction of the Monument Boulevard and Willow Pass Road interchanges, a new bridge over Walnut Creek, and a freeway-to-freeway interchange between the two routes.

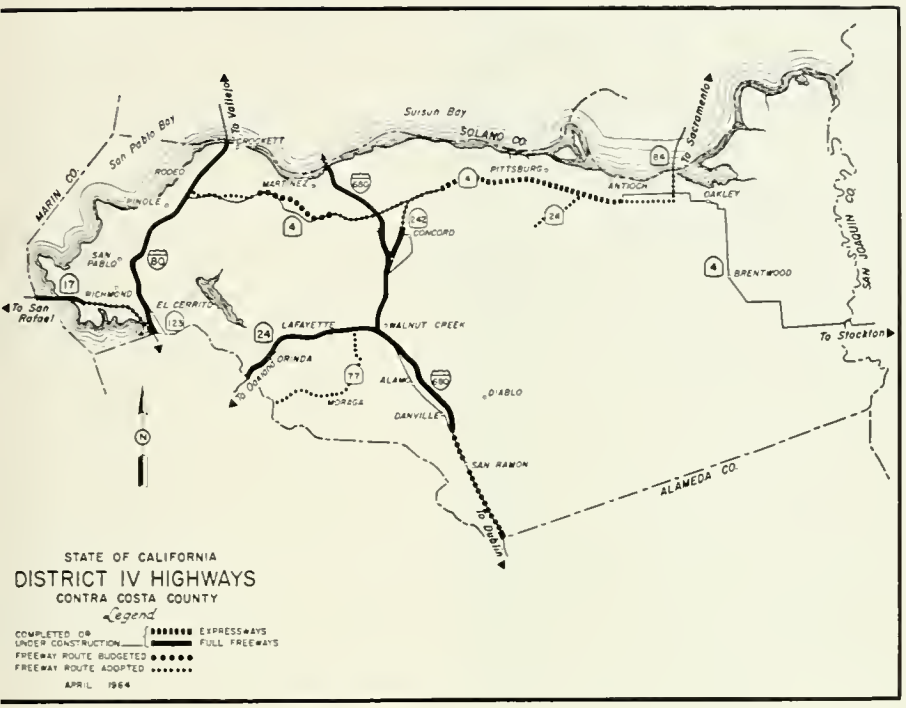
This work was accomplished by a joint venture of Gordon H. Ball, Gordon H. Ball, Inc., and Price and Harris Construction Company. The balance of the project, extending easterly into Concord, is scheduled to be ready for traffic in September.

Largest Contract

The largest freeway contract in Bay area history is now under construction on Interstate 680. It is a $13,750,000 job to construct 6.8 miles of four-lane freeway between Walnut Creek and Danville. Guy F. Atkinson Company is building the project, which is scheduled for completion in 1964.

The job includes the construction of 10 grade separation structures including overheads over the Southern Pacific Railroad at Danville and South Walnut Creek, and four bridges across San Ramon Creek. When the project is open to traffic this fall, it will replace existing Sign Route 21, which was built on an old wagon road between San Jose and Martinez that had been dedicated as a public road by the court of sessions in 1850.

On another part of Interstate 680, a 3.1-mile section on new alignment be-



een 0.4 mile south of Interstate 580 l one mile north of the Alameda-ntra Costa line, work started on rch 6, 1964. (See Alameda County.)

Design studies are nearing comple-n for the remaining 5.7 miles of erstate Route 680 in Contra Costa unty between the northerly end of above project and one mile south Danville.

Main structural feature of this sec-n will be an interchange at Crow nyon Road. Cost of the project will an estimated $7,700,000, $4,700,000 which has been budgeted for the 64–65 fiscal year program and the nainder of which will be financed the 1965–66 budget.

Landscaping and Drainage

A project for landscaping four miles the completed freeway between alden Road and the north city limits Pleasant Hill is under design study. A $26,200 contract for drainage im-ovements on Route 680 between nter Avenue and Grayson Court in checo was finished on April 1, 1964. ain feature of this job was the in-llation of a 24-inch reinforced con-ete pipe culvert between the free-y and Berry Drive, the frontage ad.

Route 4

Another sizable job in Contra Costa County planned for the near future is the construction of almost five miles of four-lane freeway between 0.2 mile west of Cummings Skyway and 0.1 mile west of Howe Road in Martinez. This work, which is generally on new alignment, includes several interchanges and grade separation structures, as well as undercrossings for fire trails and farm roads.

Plans are complete and right-of-way is being acquired for this $7,800,000 job, which is included in the 1964–65 fiscal year construction program. Another $275,000 has been budgeted for resurfacing and reconstructing portions of the existing road between Willow Road and Cummings Skyway.

Freeway agreements have been executed for the remaining portions of Route 4 that are not up to freeway standards between Route 80 at Hercules and Willow Pass Road east of Concord.

The location of Route 4 has been adopted in the vicinity of Antioch and design studies are in progress for a four-lane freeway between A Street and the Route 4–84 interchange near Neroly Road. First construction on this project will also include the initial

Looking north along Interstate 680 in Pleasant Hill. This new 1.7-mile section between Monument Boulevard in Concord and Willow Pass Road opened to traffic on January 6, 1964.

Construction on on eight-lane freeway on Route 24 shows the east portal of Caldecott Tunnel with the new bore directly to the right.

two lanes of a future four-lane freeway on Route 84 between the Route 4 84 interchange and the existing highway.

Route 24

Work on approximately two miles of eight-lane freeway between the east portal of Caldecott Tunnel and Orinda Highway on Route 24 is nearly 62 percent complete. The contract on this $6,974,000 project is being performed by a joint venture of Frederickson & Watson Construction Company and the Granite Construction Company.

There will be interchanges at both the east portal of the tunnel and at Gateway Boulevard. Chain cable-link median barrier will be installed in most of the project, with blocked-out metal beam barrier placed in the interchange areas. Completion of this job is scheduled for October.

Interstate Route 80

A $182,500 job for emergency slide correction at San Pablo Creek was completed on February 26, 1964, by Oscar C. Holmes, Inc. The work included stabilizing the east bank of the creek for roadway embankment protection, slide correction, extending a concrete box culvert, and replacing 400 feet of channel lining.

Work is expected to be finished this summer on the Barrett Avenue off-ramp construction in the City of Richmond. O. C. Jones & Sons is pe forming the work on this $438,0 contract, which will improve acc to the downtown area. This proje includes the installation of an irrig tion system and the placing of trees, 770 shrubs, and 2,500 plants f ground cover.

Marwais Steel Company start work on February 10, 1964, installi 9.6 miles of median barrier on Rou 80 between San Pablo Dam Road a the Carquinez Straits Bridge. Son $392,000 has been allotted for th work, which is scheduled for compl tion in July.

The 1964–65 budget includes $300 000 of the construction of two ramp at County Road 20 on Route 80. Th project is currently under desig study. Also under study is the pro posed addition of lanes to Interstat 80 between County Road 20 and th Carquinez Bridge.

Other Routes

Freeway agreements have been ne gotiated and design has been starte for the construction of some six mil of four- and six-lane freeway o Route 17 between El Cerrito Over head and Marine Street in Richmon

A public hearing was held on Feb ruary 19, 1964, for the presentation planning studies for portions of Rout 93 from San Pablo Dam to Route 1 in Richmond. This project involv cooperation with the Rapid Trans District in providing the proper loca tions for both highway and trans facilities.

Design studies are in progress fo future construction on Route 77 be tween Route 13 and Route 24 ne Lafayette. Some funds have been pro vided to permit purchase of right-o way along this portion of the rou to prevent the construction of expe sive improvements within the futu rights-of-way. Planning studies a under way for that portion of Rou 77 between Route 24 and Route 6 near Concord.

MARIN COUNTY

Although there are only two major construction projects currently underway in Marin County, the costs involved add up to almost $8,500,000. When both have been opened to traffic, which is expected early in 1965, US Highway 101 will have been converted to full freeway standards from the Golden Gate Bridge to south of Novato.

Route 101

A project to construct 2.7 miles six- (ultimate eight-) lane freeway b tween 0.2 mile south of Miller Cre Road and 0.3 mile north of Entra

e is approximately 62 percent
plete.
terchanges at both Ignacio (San
) Boulevard and Bolling Drive in
vicinity of Pacheco Creek are be-
built, with access to Hamilton Air
e Base to be provided by a front-
road between these interchanges.
bing lanes in both directions are
g added over St. Vincent's Hill.
he work is being performed by a
venture of Syar & Harms, Gor-
H. Ball, and Gordon H. Ball, Inc.
cost of $4,241,000.

mediately to the north of the
e construction, a $4,278,000 job
progress to construct five major
tures—most prominent of which
interchange to provide freeway-
eeway facilities between Route
and Route 37. This interchange
help eliminate traffic backup
ed by commuters and weekend
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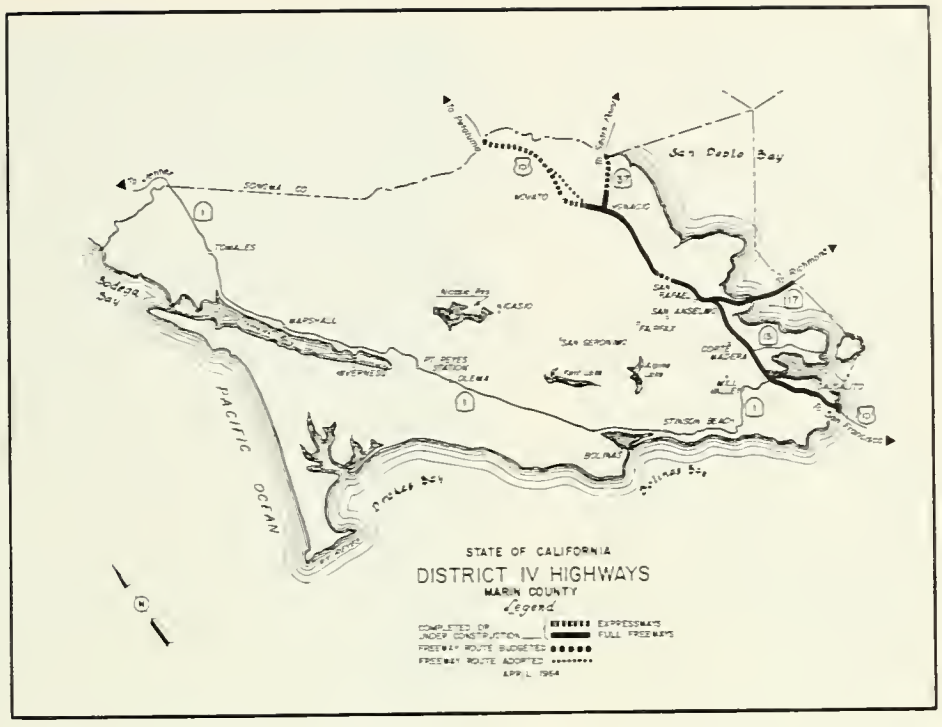
rt areas. Peter Kiewit Sons' Com-
is the contractor.



Smaller Jobs

Work was completed on February 1964, on the construction of four uphill and the installation of new signing and resurfacing on 3.2 miles of freeway between the Golden Gate Bridge and the Waldo Undercrossing. Healy Tibbitts Company accomplished this $283,000 job.

al view of the recently completed section of Route 131, Tiburon Boulevard, looks west to the Alto Wye Interchange at Route 101.

Plans have been completed for the provision of rest room facilities for the comfort of visitors to the Vista Point area.

Reichhold & Jurkovich completed a $131,000 job for the installation of underdrains and shoulder reconstruction on Route 101 between Route 37 and the Sonoma county line on August 16, 1963.

Median Barrier

Work started on March 9, 1964, for the installation of 5.5 miles of median barrier between 0.4 mile south of Waldo Undercrossing and Corte Madera Creek. Wulfert Company, Inc. is the contractor on the $187,000 job, which will include the placing of both blocked-out metal beam and chain link barrier.

Several types of experimental glare shields are to be used, including both vertical and diagonal plastic strips and, in addition, expanded metal mesh screening. The federal government has contributed $40,000 to this project.

A $105,000 job to install 1.9 miles of median barrier between Willow Avenue and the San Rafael viaduct was completed on April 30, 1963, by Charles E. Milleman.

Landscaping

Glens Falls Insurance Company is accomplishing an $88,500 landscaping job at Terra Linda Interchange (Manual Freitas Parkway). This contract includes the planting of 80 trees, 700 shrubs, and 157,000 ground cover plants, as well as an irrigation system and a small maintenance building. Completion date is in August 1964.

A landscaping project between 0.3 mile south and 0.8 mile north of Corte Madera Creek is in the design stage.

Future Projects

Design is well advanced on the first of several projects for the conversion of six miles of Route 101 to eight-lane freeway between San Quentin Wye and Miller Creek Road interchanges.

Some $500,000 has been budgeted for this work, which will consist of the realignment of streets and off-ramps between 0.3 mile south of Irwin Street and Third Street, in San Rafael in preparation for future freeway widening.

A job to resurface, reconstruct shoulders, and install underdrains on portions of Route 101 for 4.9 miles between Novato and the Sonoma county line is listed in the 1964–65 construction program, which contains an item of $180,000 for this purpose. A similar project was completed last year and design studies are in progress to complete the remaining portions of this route within these limits.

Other Routes

Work was completed on October 20, 1963, on a $618,000 job to convert the one-mile section of Route 131, Tiburon Boulevard, from Route 101 at the Alto Wye to 0.4 mile east of Strawberry Drive to a four-lane divided highway by Brown-Ely Company.

Plans have been completed for the construction of approximately one mile of four-lane divided roadway between Blackfield Drive and Reed's Underpass at Trestle Glen on the same route.

Studies are still in the planning stage on the Route 17 extension between Point San Quentin and Point Reyes Station.

This view of the Ignacio Wye Interchange project on Route 101, the Redwood Highway, at Route 37 looks southerly toward Hamilton Air Force Base.

NAPA COUNTY

Major highway development in recent years in Napa County has generally been confined to initial stage construction of two- and four-lane expressways on adopted freeway routes in the vicinity of the City of Napa.

This steady improvement to bring the state routes within the county up to modern highway standards is being continued, with work presently in progress along Route 29 and future plans for construction along Routes 121 and 128.

Route 29

Widening of 4.7 miles of Route 29 between south of Yount Road and Oakville was completed on September 18, 1963. This $626,000 job, accomplished by Lee J. Immel, included the construction of frontage roads and drainage improvements between Dry Creek and California Drive and required slightly more than one year to complete.

Major feature of a $955,000 job currently in progress is the First Street Interchange in Napa (see photograph). Completion of the project this spring will eliminate traffic congestion at the present signalized intersection.

The balance of the work, which is being performed by Lee J. Immel, includes grading and surfacing 2.2 miles of two-lane pavement and resurfacing an existing two-lane highway to provide a four-lane freeway from Old Sonoma Road to Napa Creek. Also included are a bridge over Napa Creek and frontage roads.

Future Jobs

Design studies are in progress on a project to build 1.4 miles of four-lane freeway between Napa Creek and Trancas Street. This work, tentatively planned for construction in the next few years, includes a cooperative storm drain project with Napa City and County.

Bids were opened on April 29, 1964, for an interim project to increase skid resistance by resurfacing portions of the existing pavement on Route 29 between two miles north of Trancas Street and 2.7 miles south of Yountville. The construction budget provides $22,000 for this work.

Design is also under way for a two-lane expressway (ultimate four-lane freeway) between two miles north of Yountville and Ritchie Creek, bypassing St. Helena.

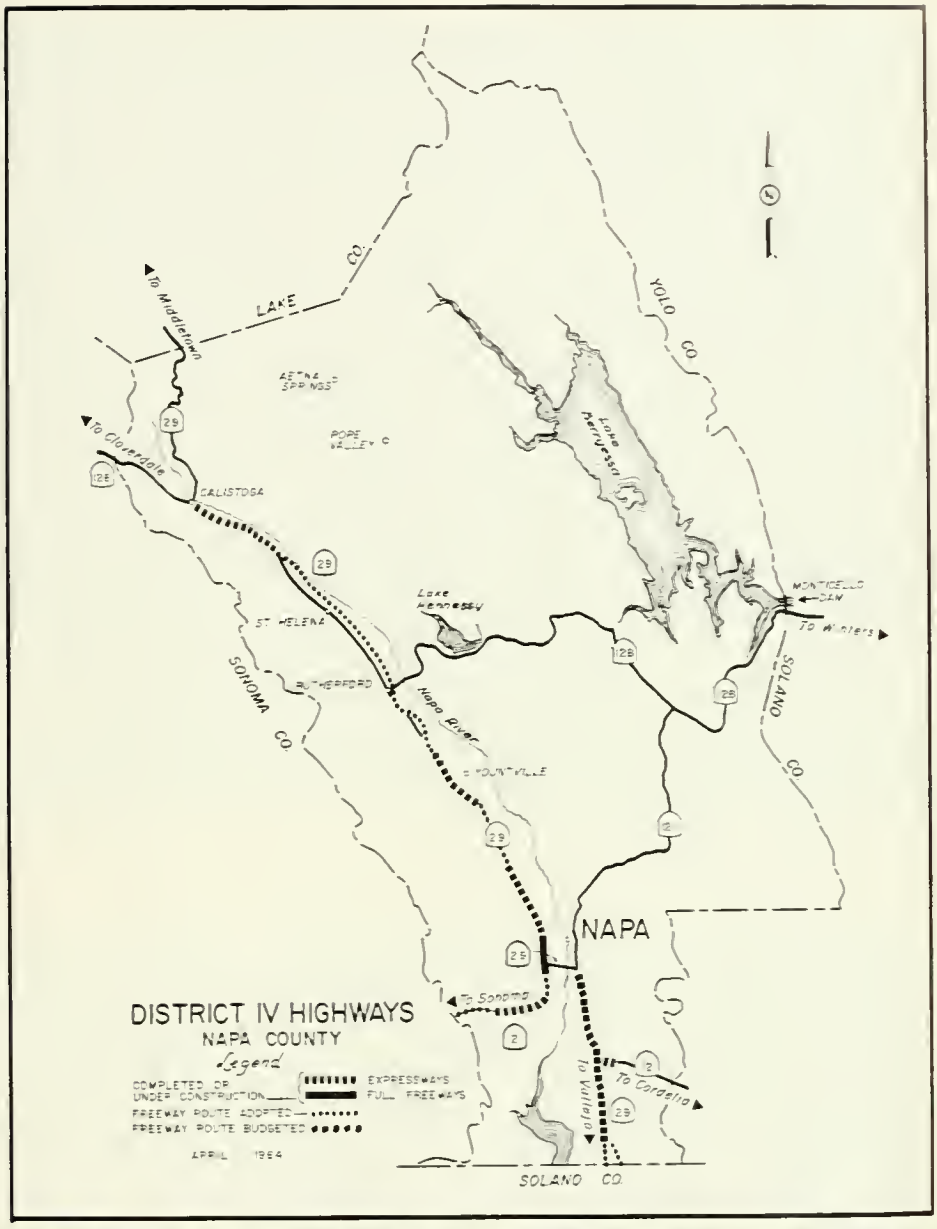
Other Routes

Bids were opened on June 3, 1964, for construction of a 1.2-mile section of 26-foot wide, all-paved roadway on Route 121 about two miles northeast of Vichy Avenue. Some $65,000 has been included in the 1964–65 construction program budget for this purpose.

Design studies are in progress for the reconstruction of approximately one mile of Route 128 as part of the continuing improvement program.

Plans are complete and $31,000 has been budgeted for minor realignment and widening of Route 128, about 10 miles east of Route 29.

Some $185,000 has been budgeted for resurfacing approximately 20 miles of various routes in Napa and Sonoma Counties as part of a continuing program.



The First Street Interchange in the City of Napa on Route 29 will, when completed, help eliminate the traffic congestion shown here.

SAN FRANCISCO COUNTY

In the City and County of San Francisco, freeway construction is almost always in the million-dollar bracket.

Of four contiguous contracts, which, when completed, will provide almost 10 miles of six-lane continuous freeway between the Route 101 interchange in San Francisco and Eastmoor Avenue in Daly City on Routes 82, 1, and 280, one has been completed, two are scheduled for completion in September of this year, and the last started in April of 1964.

Route 82

A section of six-lane (ultimate eight-lane) freeway opened to traffic on October 18, 1963. The $4,273,000 project, which was built by Charles L. Harney, Inc., runs between the interchange with James Lick (Bayshore) Freeway and Milton Street. The job included extensive relocation of Alemany Boulevard through the existing natural corridor to accommodate the freeway facilities and construction of two major overcrossing structures to serve local traffic, as well as other facilities.

East of Route 101, the James Lick Freeway, work was completed on February 14, 1964, on the two-level viaduct on Route 82 between the Route 82 101 interchange and Newcomb Avenue. This $4,100,000 project, which was built by Peter Kiewit Sons' Company, will not be usable until the next unit, extending to Army Street, is constructed.

Bids will be opened on May 20, 1964, for the construction of this extension. Within this portion, between Newcomb Avenue and Army Street, the structure will gradually change from a double-deck to a single-deck viaduct in the vicinity of Evans Avenue. Ramp connections on this project, for which $6,100,000 has been budgeted, are an integral part of the future Islais Creek Interchange at the junction of Routes 82 and 87.

The remainder of the route has been adopted by the California Highway Commission. When complete, this freeway will provide much needed relief to Route 101 northerly of its interchange with Route 82.

Projects Under Construction

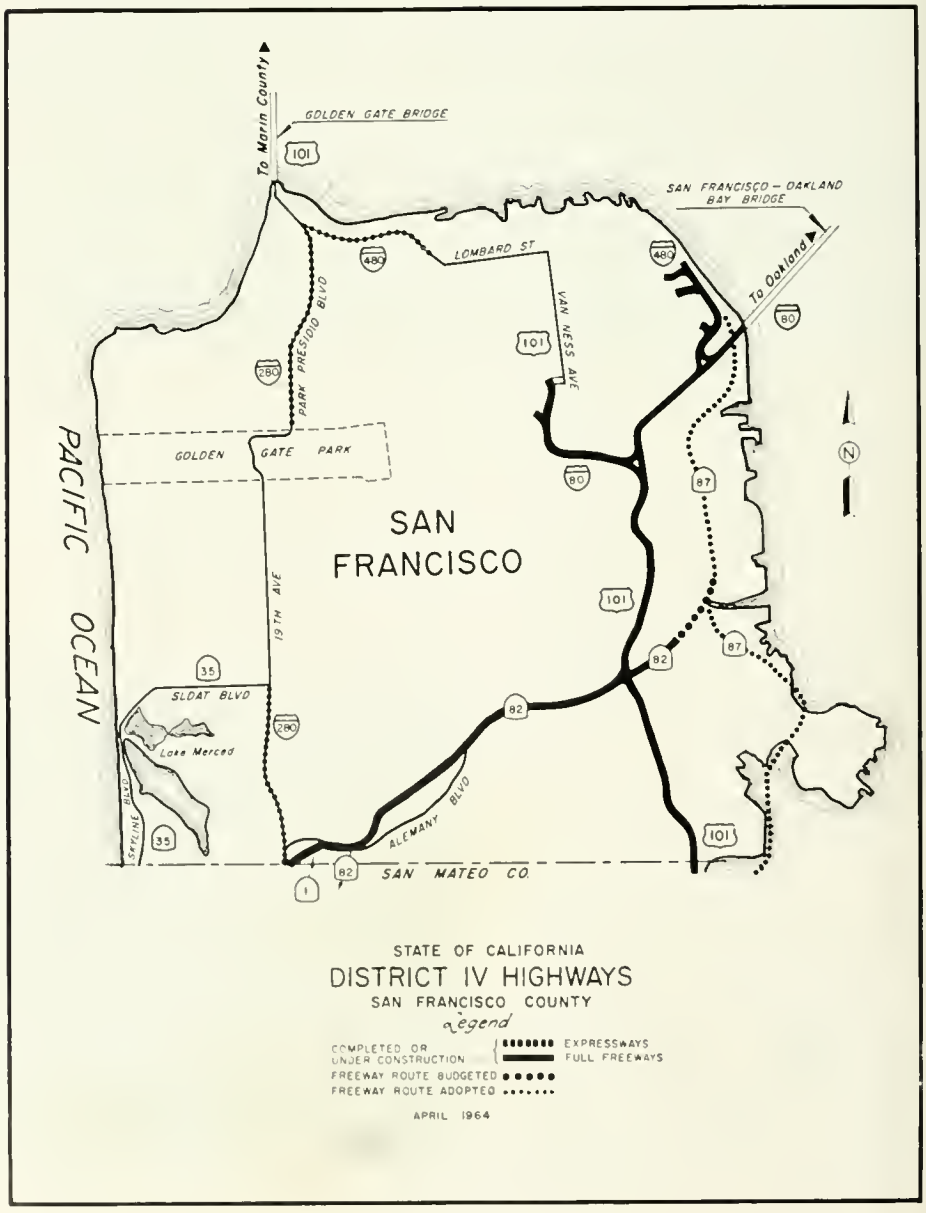
Two projects are currently under way to complete Route 82 between the James Lick Freeway and Orizaba Avenue near the south city limits of San Francisco.

The first is a $6,080,000 project for the construction of 1.1 miles of six-lane freeway between Mission Street and Ocean Avenue. It includes the construction of 13 traffic separation and interchange structures.

Traffic will not be able to use this unit until after the adjacent section, that between Ocean and Orizaba Avenue, has been completed.

Both projects, which are being built by Charles L. Harney, are scheduled to be finished this fall.

The unit between Ocean and Orizaba runs for 1.8 miles. This job, which is being built at a cost of $4,581,000, includes the construction of an interchange at Ocean Avenue and a number of access ramps, overcrossings, and other traffic separation structures.



An unusual feature of this job is construction of bus stop facilities Ocean Avenue to permit passengers m express buses on the freeway to nsfer to local buses on Geneva and ean Avenues.

Landscaping

As each construction phase on Route is completed, landscaping will fol-. Plans for landscaping that portion Route 82 between Route 101 and ton Street are complete. The sum $110,000 has been budgeted and s will be received on June 3.

Design studies are underway for dscaping the one-mile section be-een Havelock and Mission Streets en the freeway construction within se limits has been completed. The 4–65 construction budget contains ,000 for this purpose.

A project for landscaping that sec-n of Route 82 between Orizaba and ean Avenues, currently under con-ction, will be included in a future lget.

Route 87

Freeway agreements have been exe-ed for the portion of Route 87 ween Evans Avenue and Sixth and nnan Streets, which will eventually a six- and eight-lane freeway. De-n studies are now in progress, and portion between Evans Avenue l 18th Street will be built first.

Design studies are being made and paration of preliminary freeway eements is under way for the sec-n of Route 87 from Sixth Street to junction with Interstate 480 in the inity of Howard Street.

Route 1

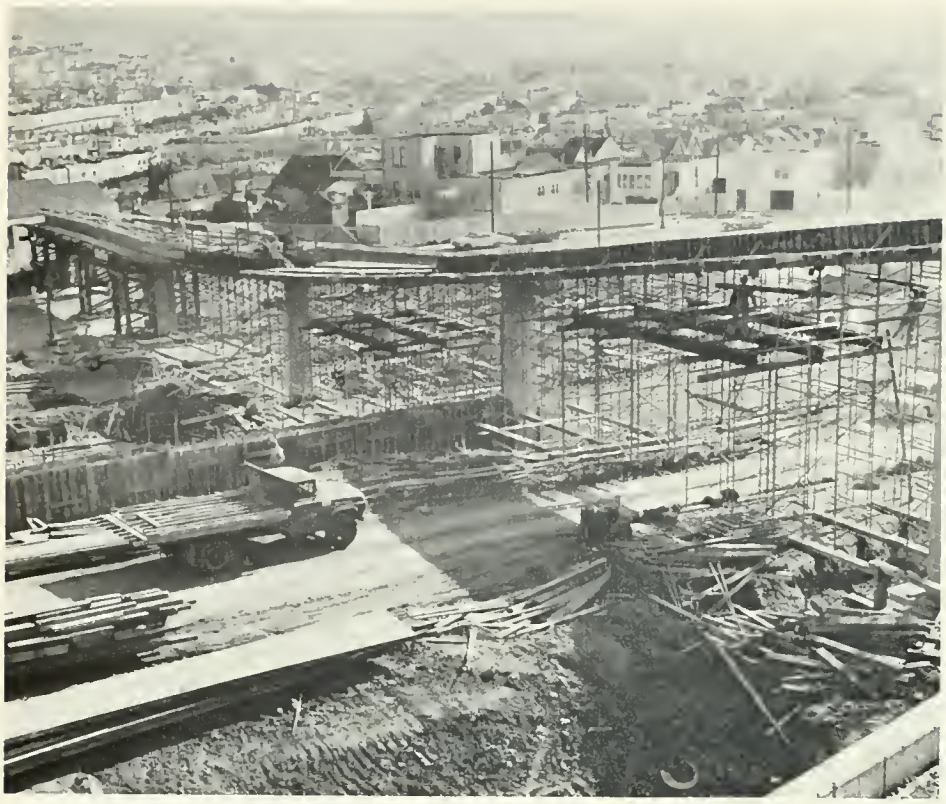
Route 1 is a connection between ute 82 near Orizaba Avenue in San ncisco and Interstate Route 280 in vicinity of the Alemany Boulevard ension in Daly City.

Work on this route started on April 1964, as a part of a $9,978,000 con-ct on Interstate Route 280 in the inity of Daly City being built by ter Kiewit Sons' Company. (See n Mateo County.)

The portion of the contract involv-Route 1 includes the construction

Aerial photo looks west from the vicinity of Newcamb Street toward the intersection with James Lick (Royshore) Freeway showing the section of double-deck viaduct that was completed in February. This unit will not be usable until the next section, extending to Army Street, is constructed.

Paving operations along a section of six-lane freeway being built on Route 82 in San Francisco.



The Thereso Street Pedestrian Overcrossing is shown under construction with forms in place for pouring the side railing. The job is on the Ocean Avenue to Mission Street section of Route 82.

View looking east shows grading work in progress for the relocation of San Jose Avenue and falsework for the access ramp from San Jose Avenue on the Mission Street to Ocean Avenue section of Route 82.

of traffic separations at Alemany Boulevard and near St. Charles Avenue, in addition to the freeway connection between Routes 82 and 280.

Route 480

Work started on December 18, 1963, on a $1,443,000 job to grade, pave and build the structures of the Clay and Washington Street ramps connecting Route 480 with the Golden Gateway Redevelopment project.

This job, which is being performed by Stolte, Inc., is due to be finished in December 1964. Work, which includes installation of sign structures, signs, and lighting, is being coordinated with a future city contract for the widening of Clay and Washington Streets and with another city contract, currently underway, for the installation of a city sewer main and pumping station on Drumm Street.

An interesting feature of this job is the driving of 37,000 feet of steel "H" piling, ranging in length from 150 to 210 feet.

Studies have started on the extension of Route 480 between the present end of the freeway at Broadway and the Golden Gate Bridge approaches as requested by the board of supervisors' resolution of October 21, 1963.

Other Routes

A public hearing, attended by some 500 San Franciscans, was held on April 6, 1964, for presentation of studies of several alternates, including variations of some of the alternates, for the Panhandle Parkway and Crosstown Tunnel as requested by the board of supervisors. The California Highway Commission held a public hearing on May 21.

These studies were prepared by the study coordinating committee, composed of state and city officials and aided by noted architectural consultant Lawrence Halprin.

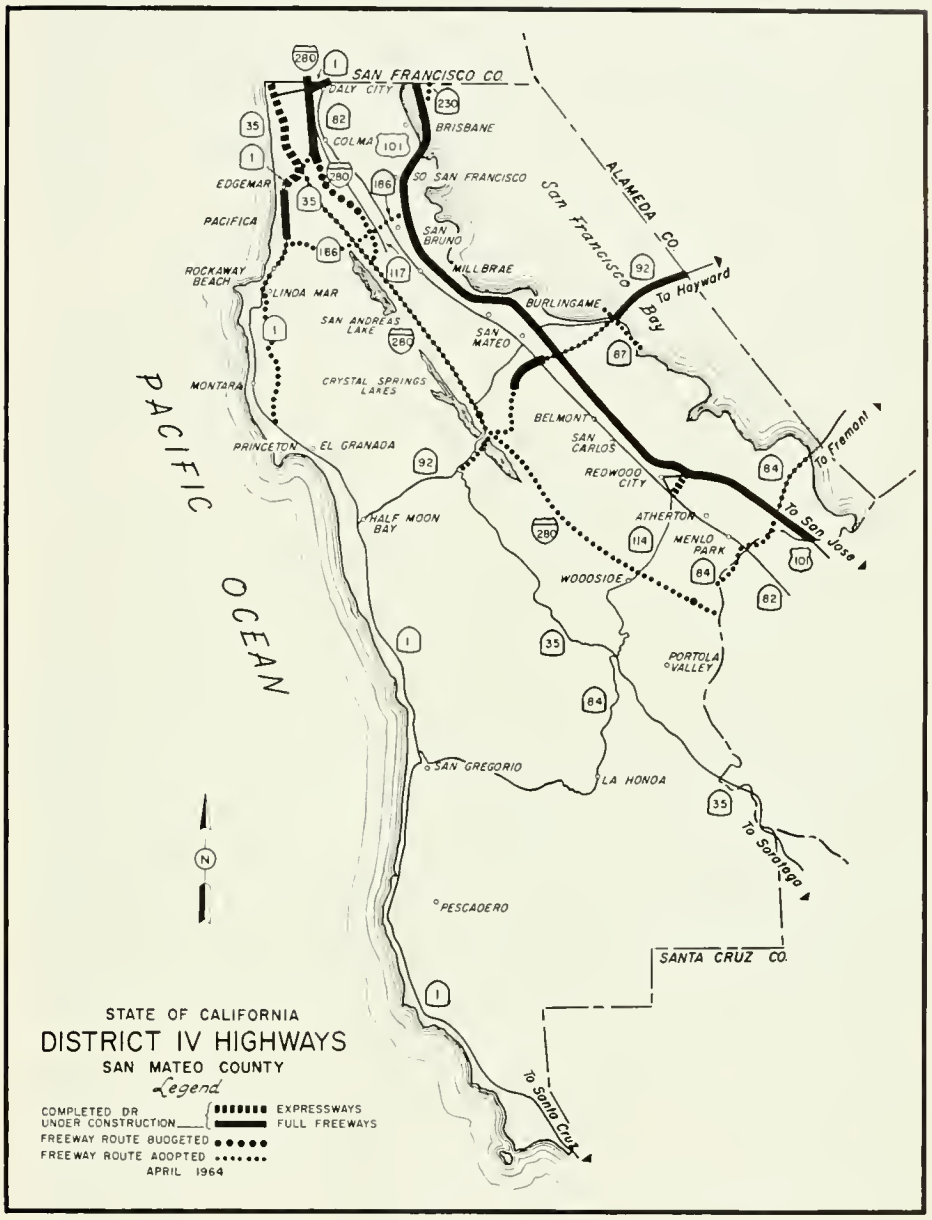
The San Francisco Board of Supervisors has also requested that studies be made for the extension of Route 101 from McAllister and Franklin Streets to Ellis and O'Farrell Streets.

SAN MATEO COUNTY

The freeway story in San Mateo County during the past year is one of going construction and plans for the future in all parts of the county.

The biggest project got underway with the start of construction on the new Interstate Route 280 at the north county limits, but other preliminary work and plans for the future are also very much in progress.

Other important work is taking place on Route 1, the Cabrillo Highway; Route 82, El Camino Real; Route 92; Route 101, the Bayshore Freeway; and on Route 114 in Redwood City.



Interstate Route 280

Work started April 8, 1964, on a $9,978,000 job to build approximately four miles of eight- and ten-lane freeway on Routes 1 (see San Francisco County) and 280 between Orizaba Avenue in San Francisco and one-half mile south of Eastmoor Avenue in Daly City.

This work, being performed by Peter Kiewit Sons' Company, includes the construction of 12 grade separations and the modification of the existing Alemany Boulevard overcrossing. Major structural feature of this job will be the construction of a three-level interchange in the vicinity of Knowles Avenue in Daly City to channel traffic satisfactorily to and from San Francisco from two directions—Route 1 and the existing Junipero Serra Boulevard.

The work also includes the realignment of Junipero Serra Boulevard to serve adjacent properties as a frontage road and the construction of other interchanges to provide access to the new Route 280.

Construction on the Route 1 part of the job includes rough grading, drainage, and frontage road facilities westerly of Interstate 280 to Route 35 and construction of the six-lane freeway connection between Route 82 near Orizaba Avenue and Route 280 in San Francisco. (See San Francisco County.)

Preliminary to the freeway construction will be the relocation of storm drains on Junipero Serra Boulevard about one-quarter mile south of Knowles Avenue. The sum of $74,000 has been allocated for this work, which Lowrie Paving Company, Inc., started on March 6, 1964.

Future Projects on 280

Partial financing has been provided in the 1964–65 budget for two separate projects on Route 280 immediately south of the above construction. Some $1,800,000 is included for the extension of the route from Eastmoor Avenue in Daly City to south of Arroyo Drive in South San Francisco. An additional $6,700,000 will be required in the 1965–66 budget to complete it.

The 1964–65 budget also includes partial financing in the amount of $2,500,000 for construction of the proposed eight-lane bridge over San Mateo Creek near Crystal Springs Dam on Interstate Route 280. A model of this bridge was seen by members of the Peninsula Highway Policy Committee on March 11, 1964. (Photo on page 24).

Aerial view of the completed four-lane elevated freeway through the City of San Mateo on Route 92 looks west showing the cloverleaf interchange with Route 82, El Camino Real, in the center.

Stanford Linear Accelerator

Bids were opened on April 8, 1964, for a bridge to carry Interstate Route 280 over the two-mile linear accelerator at Stanford University. Although this portion of Route 280 will not be usable by traffic for some time after it is constructed, it is necessary to build the bridge at this time for coordination with other work in progress by the Atomic Energy Commission.

Some $500,000 was included in the 1963–64 budget for this bridge and the required preliminary rough grading, which was completed in October.

Projects for construction of the remaining portions within San Mateo County of this important new interstate route are in various stages of design study. Some plans are being developed on the basis of a variable width median with the opposing lanes separated by varying heights as well, particularly where Route 280 passes through watershed lands owned by the City and County of San Francisco.

Three other projects on Route 280 between Route 92 at Ralston Avenue and 0.2 mile south of San Bruno Avenue are proposed for forthcoming construction programs in the next few years. It is anticipated that the entire length of Interstate 280 between San Francisco and San Jose will have been completed or be under construction by 1968.

Route 1

Construction on 2.5 miles of four-lane freeway between Sharp Park Road and Manor Drive in Pacifica is continuing, with completion expected in January 1965. McNamara Corporation, Ltd., is the contractor on this $4,364,000 job, which includes construction of a full interchange at Sharp Park Road, traffic separations, and pedestrian crossings both over and under the freeway.

Almost one mile of reconstruction of the existing alignment of Cabrillo Highway southerly from Westport Drive is included in the work.

Work is nearing completion on the Gateway Drive Undercrossing northerly of the above project. Power Construction Company is performing the $298,000 contract.

Plans are complete for an interim project to reconstruct Cabrillo Highway to four 10-foot lanes without shoulders between San Pedro Creek (Linda Mar Boulevard) and Sharp Park Road (Quarry Road). The 1964–65 budget provided $200,000 for this work in which the City of Pacifica has participated by obtaining the necessary rights of entry and slope easements by cooperative agreement with the State. Bids were opened on May 27 for this job.

The rough grading of a portion of Cabrillo Highway, as well as drainage and frontage road facilities, easterly of Route 35 is included in the project on Interstate 280 between Eastmoor Avenue in Daly City and Orizaba Avenue in San Francisco.

Route 82

Work has been completed on a 1.7-mile stretch of Route 82 between Euclid Avenue in San Bruno and Millwood Drive in Millbrae in which El Camino Real was widened to a six-lane divided conventional highway, including the provision of parking aprons, sidewalks, and street lighting.

Lowrie Paving Company accomplished the $821,000 job, to which the Cities of Millbrae and San Bruno contributed almost $186,000.

This project was consistent with precedent established by other cities involved in the conversion of El Camino Real from a four-lane undivided road to a six-lane divided arterial. All cities involved have expressed willingness to participate in financing the re-

construction of such items as parking aprons, sidewalks, and street lighting.

Two other projects are currently being considered—between San Bruno Avenue in San Bruno and 0.1 miles north of Arroyo Drive in South San Francisco. Both cities have requested cooperative agreements for these projects and negotiations will soon be underway.

Route 92

Work was completed on August 29, 1963, on construction of 2.6 miles of four-lane freeway between West Hillsdale Boulevard and South Delaware Street in San Mateo.

L. C. Smith and Concar Ranch and Enterprises performed the $4,652,000 contract, which included the construction of traffic separation structures and interchanges, including an overhead crossing of the Southern Pacific Railroad near Pacific Boulevard.

A project was advertised, with bids due May 20, to landscape this section with $225,000 provided in the 1963–64 budget for this work and an additional contribution of $1,000 from the owners of the Borel Estate, adjacent property owners, specifically for the planting of small oak trees in conjunction with the landscaping work.

Design studies are in progress for the remaining portions of Route 92 between Interstate 280 and West Hillsdale Boulevard to the west of the completed portion and between South Delaware Street and the San Mateo Bridge to the east.

The California Highway Commission had previously adopted a portion of Route 92 westerly of Interstate Route 280 and Route 35 on Cahill Ridge near Mountain House.

New location studies are well advanced for the extension of Route 92 westerly from Cahill Ridge to Route 1 near Half Moon Bay. Plans for the replacement of Pilarcitos Creek Bridge are nearing completion.

Route 101

Work started on March 16, 1964, on the construction of some 19 miles of median barrier on the Bayshore Freeway between Redwood Creek Bridge in Redwood City and Route 87 in San Jose.

The U.S. Steel Corporation is accomplishing this $312,000 job, which includes the placing of one-half mile of single, blocked-out metal beam barrier, 18½ miles of cable-chain link, erection of sign structures, and the installation of sign lighting systems between University Avenue in Palo Alto and Redwood City.

Bragato Paving Company & Blomquist Oil Service, Inc., are carrying on an $862,000 resurfacing and leveling job on the Bayshore Freeway between Fifth Avenue in San Mateo and Whipple Avenue in Redwood City. This job is scheduled to be completed in the fall.

Bragato Paving Company also started work February 27, 1964, on construction of a drainage correction project approximately one mile north of Whipple Avenue in Redwood City at a cost of $20,400.

Design studies are in progress for widening the existing freeway to eight lanes between 19th Avenue in San Mateo and Broadway in Burlingame.

Other Routes

A joint venture of Dan Caputo Company, Bragato Paving Company, and Bellshore Corporation has finished approximately one-fourth of a $2,250,000 contract to build 1.3 miles of four-lane expressway on Route 114 between Cypress Avenue, south of El Camino Real, and the Bayshore Freeway.

The City of Redwood City has contributed $1,000,000 to the cost of this project, whose major structural feature will be the construction of a full

Aerial view looks north along El Camino Real, Route 82, showing the recently completed six-lane divided highway from Millbrae to San Bruno. Tanforan Racetrack appears top right.

interchange to replace the existing, hazardous signalized intersection at "five points" on El Camino Real in Redwood City.

Design studies for widening Route 114, Woodside Road, between Locust Street and Interstate 280 in Woodside to a conventional four-lane highway and to provide for the construction of passing lanes on portions of Woodside Road are in progress.

Design studies are in progress for Route 186 between Route 35 and the Bayshore Freeway. Aerial mapping has been completed and freeway agreements are being discussed with the local jurisdictions. The westerly projection of Route 186 from Sweeney Ridge, west of Route 35, to Route 1 was adopted by the California Highway Commission on December 19, 1963.

Bids were opened May 6 on a project for resurfacing Route 35 from 0.2 mile north of its junction with Route 1 and 0.2 mile south of the Alemany Boulevard extension in Daly City.

Design studies for an initial four-lane freeway between Crystal Springs Road in San Bruno and the junction of Routes 1 and 35 on Route 35 are proceeding sufficiently well to set right-of-way requirements.

SANTA CLARA COUNTY

The major emphasis on freeway construction in Santa Clara County during the past year continued to be work on the new Interstate Route 280 and the equally new State Route 85 along Stevens Creek.

Interstate Route 280

The first major unit of Interstate Route 280 was opened to traffic on March 16, 1964. It consisted of three miles of six-lane freeway on new alignment from Route 17 to a short distance west of Saratoga Avenue in San Jose.

A joint venture of Gibbons & Reed and Dan Caputo Company performed the $4,754,000 contract, which included the addition of inside lanes to the existing four-lane section of Route 17 between Forest and Moorpark Avenues.

Major structural feature on the job was the modification of the cloverleaf interchange on the existing freeway to provide direct freeway-to-freeway connections and accommodate collector roads.

This contract included the grading of Route 280 from Saratoga Avenue westerly to Stevens Creek Road in the vicinity of Doyle Avenue. That portion is now being paved under a separate contract.

Widening Job

A $1,124,000 project to widen 3.4 miles of Interstate 280 between Forest Avenue in San Jose and the Bayshore Freeway from four to six lanes was completed on December 6, 1963, by a joint venture of Gibbons & Reed and Dan Caputo Company.

The work included addition and revision of access ramps, installation of cable-chain link and metal beam median barrier, traffic signals, highway lighting, and sign illumination.

Work in Progress

Westerly of the above project, work is well underway on the construction of 4.7 miles of Interstate Route 280 between Saratoga Avenue in San Jose and Stelling Road in Cupertino.

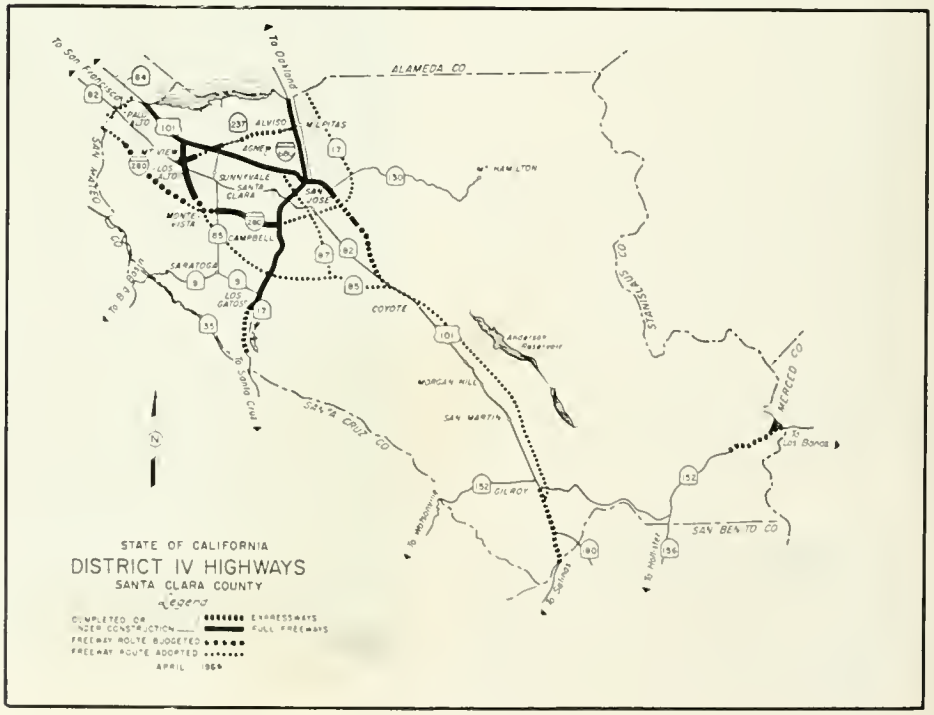
Frederickson & Watson Construction Company is performing this $4,432,000 job, which includes the construction of three interchanges and a traffic separation structure. The freeway will be elevated in the vicinity of Lawrence Expressway-Stevens Creek Boulevard and depressed from Saratoga-Sunnyvale Road to Stelling Road.

When completed late this year, the project will be usable to Saratoga-Sunnyvale Road, with grading only having been accomplished from there to Stelling Road.

Foothill College

Work was completed on March 30, 1964, by L. C. Smith Company on the grading and surfacing of one-half mile of El Monte Avenue to provide a four-lane street with revised connection to Foothill College in preparation for the construction of El Monte Avenue Interchange on Route 280 in Los Altos Hills.

The project, which was undertaken in accordance with plans of the local jurisdictions to develop El Monte



Avenue as a major thoroughfare, cost $212,000, of which $31,500 was contributed by the Foothill Junior College District.

Plans for the Future

Funds for two separate projects on Interstate Route 280 have been included in the 1964–65 construction budget. One on which bids were opened on May 27, is for the construction of a six-lane, ultimate eight-lane, freeway between Saratoga-Sunnyvale Road and the Southern Pacific Railroad, including a four-lane connection to Route 85, for which $1,100,000 has been budgeted.

The other is for the construction of seven miles of Interstate Route 280 between Foothill Boulevard and north of Page Mill Road. The 1964–65 budget contains $3,000,000 for this purpose, with an additional $5,900,000 required in the 1965–66 budget to complete the job.

Design studies are in progress for the remaining portions of Interstate 280 in Santa Clara County.

Route 17

Design studies are underway for revisions to the interchange at Camden Avenue on Route 17 to allow a connection with Santa Clara County's San Tomas Expressway.

Design studies are also in progress for the construction of Route 17 between Route 280 at Moorpark Avenue and Route 130 at Alum Rock Avenue. Freeway agreements have been executed and connection of the Capitol Expressway, which has been requested by local jurisdictions, is under consideration. This seven-mile project will be constructed to interstate standards because of its importance as a major traffic carrier.

Studies are also being made for the extension of Route 17 between Alum Rock Avenue and Route 680 near the Warm Springs area of Fremont.

Route 82

Work was completed on March 28, 1963, on the conversion of 2.1 miles of El Camino Real in the City of Palo Alto to six-lane divided highway. McGuire & Hester performed this $1,440,000 contract. $504,000 of which was provided by the City of Palo Alto.

Aerial view looks east at a section of Interstate Route 280 which was opened to traffic on March 16, 1964. The Saratoga Avenue Interchange is shown in the foreground.

Bids were opened on April 22, 1964, for the construction of five miles of four-lane, ultimate six-lane divided highway on Route 82 between Ford Road and Curtner Avenue in San Jose.

Completion of this project will eliminate one of the last remaining sections of three-lane highway in Santa Clara County. Some $1,142,000 is available for this work.

Design studies are under consideration for cooperative improvements on El Camino Real between Santa Clara and Palo Alto to widen the existing highway to a six-lane conventional facility within a 120-foot right-of-way.

Route 85

Construction of 5½ miles of four- and six-lane freeway between Homestead Road in Cupertino and the Bayshore Freeway in Mountain View is in progress.

This first unit of a completely new freeway, which generally parallels Stevens Creek, is being built by a joint venture of L. C. Smith Company, Concar Ranch and Enterprises, Inc., and Gordon H. Ball Enterprises for a contract allotment of $6,560,000, including some funds contributed by the City of Mountain View, the Department of the Navy, and the Cupertino Sanitary Sewer District.

The project includes the construction of seven interchanges, plus other traffic separation structures. Funds have also been budgeted for a cooperative project to build an overcrossing at Middlefield Road.

Design studies to continue Route 85 southerly from Homestead Road to Route 17 are in progress.

Route 101

A project for functional and tree planting on 2.2 miles of Bayshore

Freeway between Morse Avenue and Agnew Road in the vicinity of San Jose was completed on February 27, 1964, by a joint venture of Gravelle & McConnell, Inc., and Collishaw Sprinkler Company.

The $90,700 job included the planting of 800 trees, more than 2,300 shrubs, and almost one-half million ice plants for ground cover. It also included installation of an irrigation system.

A project to resurface Route 101 between El Toro Avenue in Morgan Hill and the north end of Llagas Creek was completed on March 13, 1964. Raisch Construction Company accomplished the $303,000 job, which included the installation of signals and the construction of left-turn storage lanes at the intersections with major roads within the limits of the project.

U.S. Steel Corporation started work on March 16, 1964, on the construction of some 19 miles of median barrier between Redwood Creek Bridge in Redwood City and Route 87 in San Jose. (See San Mateo County for discussion of this $312,000 project.)

Oregon Avenue Interchange

A joint venture of Gordon H. Ball and Homer J. Olsen started work on March 31, 1964, on the construction of a trumpet-type interchange on Route 101 in Palo Alto to serve the future Oregon Avenue Expressway of the County of Santa Clara, which is now under construction by the County south of and adjacent to existing Oregon Avenue.

The sum of $724,000 has been allocated for this work, which will include the augmentation of the existing Embarcadero Road Interchange on Route 101 and the necessary revision of ramps and frontage roads that are required.

This job is scheduled to be completed late this fall.

Future Projects

Design studies have been completed on a project for the construction of the Capitol Expressway and Hellyer Avenue interchanges between south of Tully Road and Coyote Creek. The 1964–65 budget contains $1,155,000 for this purpose.

Design studies are also in progress for the conversion of the present expressway between McKee Road in San Jose and Ford Road, and the 4.8 miles of expressway between Thomas Road and the San Benito county line, to future eight-lane freeway.

The first unit of this latter job will include a one-mile line change near and replacement of the southbound structure for the Sargent Overhead, over the Southern Pacific tracks south of Gilroy. Surveys for this work are in progress.

Design studies are also under way for the freeway bypass of Gilroy and

Picture shows cleared right-of-way for the future Route 237, with a closeup of the Donu Rood Overcrossing under construction.

gan Hill between Thomas Road Route 82 near Ford Road.

Route 237

joint venture of L. C. Smith Com- and Concar Ranch & Enterprises, is building 1.6 miles of two- and -lane freeway on Route 237 be- n El Camino Real and Bernardo nue in Mountain View at a cost of 67,000.

he two-lane portion of this proj- which is expected to be completed summer, is between Sylvan and ardo Avenues. It will provide the herly lanes of a future four-lane way.

esign studies have been initiated he development of an initial four- ultimate six-lane, freeway on te 237 between Bernardo Avenue Interstate 680 in the vicinity of itas.

reeman Paving Company & O. C. nes, Inc., are working under a ,000 cooperative contract to build mile of roadway between the a Clara-Alviso Road and the dalupe Bridge Road and construct a new bridge and approaches over the Guadalupe River.

The State's share of this work, which should be finished this fall, is $30,000, with $213,300 contributed by the Santa Clara County Flood Control and Water District for the replacement of the bridge over the new flood control channel and for rights-of-way.

Route 87

Design studies are in progress for the ultimate construction of 2.7 miles of freeway on Route 87 between Coleman and Market Streets in San Jose and Route 101. The remainder of the route between Coleman and Market and Route 85 has been adopted and aerial mapping has been requested.

The County of Santa Clara is furnishing rights-of-way for both projects and has approved the geometrics for that portion between Coleman and Market and Route 101.

Route 152

Granite Construction Company completed a $401,000 job to widen and resurface 5.7 miles of highway some 14 miles east of Gilroy in the vicinity of Bell's Station on December 19, 1963.

A similar widening and resurfacing project on Route 152 between 1.2 miles east of Bloomfield and San Felipe is financed in the 1964–65 budget, which provides $350,000 for the purpose.

State Sign Route 9

Raisch Construction Company completed a $696,000 job to widen 5.4 miles of the existing highway between Azule in Saratoga and El Camino Real in Sunnyvale on September 20, 1963. The job included provision of a four-lane arterial with channelization at five intersections to provide left-turn storage lanes and installation of signals.

Design studies are underway for a similar widening project on existing State Sign Route 9 between Oak Place and 0.1 mile north of the Southern Pacific Railroad at Azule on Route 85.

Rights-of-way for this work are being provided by the local jurisdiction.

SANTA CRUZ COUNTY

he major highway construction hasis in Santa Cruz County con- es to be focused on the conver- of the existing expressway on the rillo Highway to full freeway dards south of Santa Cruz.

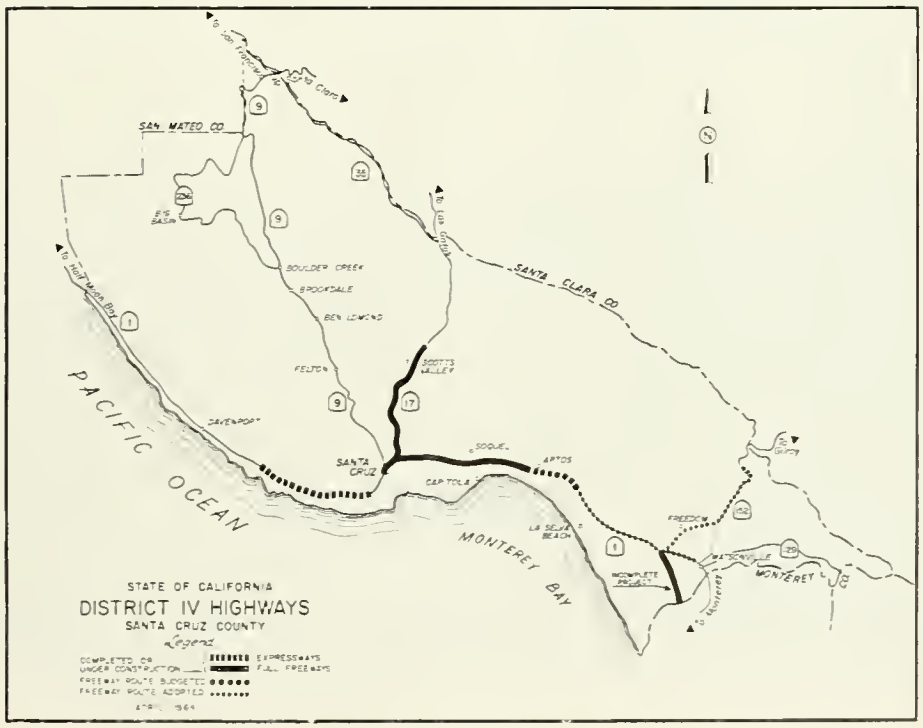
Route 1

joint venture of Granite Con- ction Company and Lew Jones struction Company completed a 72,000 job to convert 2.9 miles of essway to full four-lane (ultimate ane) freeway from 0.2 mile west Aptos Creek to 0.3 mile east of uel Wharf Road on November 22, .

ajor structural features of this k included construction of a two- drant cloverleaf interchange at e Park Drive and a diamond inter- ge at Park Avenue.

he Division of Beaches and Parks tributed $18,000 to this project, ch included the construction of tage roads.

$2,063,000 project has been un- aken by the same contractors to build the first stages of five miles of freeway between 1.2 miles south of the Pajaro River and 2.3 miles northeast of Watsonville, including the



construction of structures and rough grading for the future Watsonville Bypass.

This construction, which is on new alignment passing to the west of Watsonville, crosses marshy ground, which requires the placing of a fill surcharge to hasten settlement and aid in stabilizing the roadway embankment. Plans are being completed to remove the surcharge after a one-year settlement period.

The project also includes rough grading on portions of Route 129 connecting Route 1 with Main Street in Watsonville.

Plans for the Future

A future contract will provide for paving 3.4 miles of four-lane freeway and completing the structures between 1.2 miles south of the Pajaro River and 0.2 mile northeast of Roache Road on Route 1.

This job will include paving 1.6 miles of Route 129 between Cabrillo Highway and 0.1 mile east of Main Street in Watsonville. This project will provide access to Route 1 at the Route 1/129 Separation and at Harkins Slough Overcrossing.

Studies for the design of interchanges at Rio Del Mar Boulevard (Aptos Avenue) and Rob Roy Junction and the future addition of two lanes to the existing highway between Santa Cruz and Rob Roy, including the modification of existing interchanges, are in progress.

Conversion of the existing road between Rob Roy and the Watsonville Bypass to an initial four-lane (ultimate six-lane) freeway is also under design study.

Photograph looks down at the two-loop interchange at State Park Drive with the Cabrilla Highway, Route 1. The job of which it was a part was completed on November 22, 1963.

Other Routes

A project for functional and tree planting on Route 17 between 0.2 mile north of Cabrillo Highway and 0.4 mile north of Granite Creek Road is almost complete. This $98,000 job includes the planting of 1,100 trees, almost 5,000 shrubs, and 450,000 Hottentot figs for ground cover.

Studies are in progress for determination of rights-of-way for three miles of four-lane freeway between the new alignment of Cabrillo Highway west of Watsonville and a point one mile east of Casserly Road on Route 152.

Some $174,200 has been budgeted for resurfacing about 25 miles of various routes in Santa Clara and Santa Cruz Counties as part of a continuing program.

SONOMA COUNTY

The Sonoma County story in highway construction during the past year continued to feature steady improvement on both the Redwood Highway, US 101, and State Route 12 in the vicinity of Santa Rosa.

These improvements will insure safer traveling conditions to the motoring public and at the same time provide easier access to the recreational areas of western Sonoma County.

Route 101

A $1,123,000 job is underway to build 1.7 miles of four-lane freeway between 1.7 miles north of Canyon Road and 0.8 mile south of Washington School Road.

Fredrickson Brothers is performing the work, which, when complete in January 1965, will eliminate the curve at Zanzi's Corner on the existing route.

Major structural feature on the job is the Chianti Undercrossing, which will provide a connection between frontage roads on both sides of the freeway.

"Asti Bypass"

Another project, directly to the north, is nearing completion. Commonly known as the "Asti Bypass," it involves the construction of 3.6 miles of four-lane (ultimate six-lane) freeway between 0.8 mile south of Washington School Road and 0.6 mile north of Hiatt Road.

onstruction on the new four-lane freeway on Route 101 at Asti, known commonly as the Asti Bypass. This interchange will provide easy access to the Italian Swiss Colony winery.

McNamara Corporation is performng this $2,297,000 contract, including nterchanges and traffic separations.

Design studies are in progress for construction of the remainder of the future freeway on the Redwood Highway between Lytton and the Mendocino county line. Freeway agreements for the portion between Canyon Road and Lytton Springs Road are being negotiated.

A tree-planting project is under design study on some 12 miles of Route 101 between the Mendocino Avenue Overcrossing north of Santa Rosa and the Russian River, which was opened to traffic in December, 1962.

Design studies have been completed for the conversion of the present expressway on Route 101 through Santa Rosa to a full freeway. One major structural feature of this section, which lies between 0.1 mile south of Edwards Avenue and Russell Avenue, will be the Steele Lane Interchange. The sum of $1,170,000 has been budgeted for this interchange, for which bids were opened on May 6, 1964.

Route 12

Peter Kiewit Sons' Company is nearly 90 percent finished with a $4,896,000 job to build 5½ miles of freeway on Route 12 between Occidental Road east of Sebastopol and South E Street in Santa Rosa.

The most prominent feature of this construction project is the three-level traffic separation structure at the junction of Routes 12 and 101. (See photograph.) Other structures include construction of the Santa Rosa Creek Bridge on Route 12 and several traffic separations.

Design studies for landscaping and tree planting on the above project are

raffic began using this 5½-mile section of Interstate Route 680 between Route 238 in Fremont and Route 84 in January 1964. The view is northeast towards Scott's Corner.

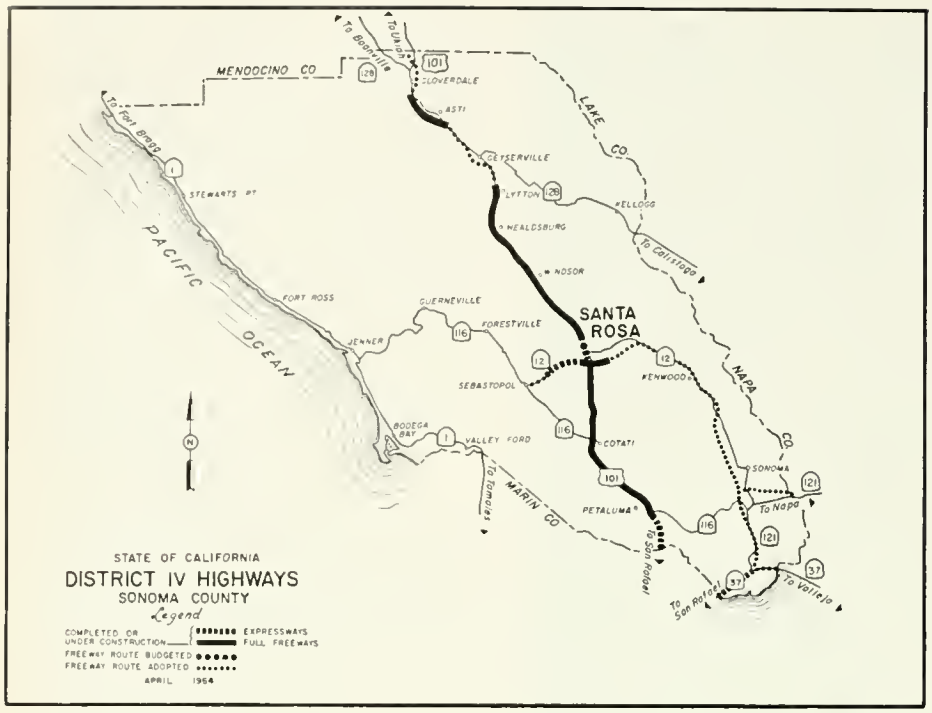


Photo shows the new three-level interchange of Routes 101 and 12 in Santo Roso. The Earle Street Pedestrian Overcrossing is in the foreground.

well advanced and $200,000 has been budgeted for this purpose.

An interim project on existing Route 12 between Brush Creek and North Melita Road is under design study. The City of Santa Rosa and Sonoma County have offered to contribute $250,000 each toward the cost of a 100-foot right-of-way to accommodate the proposed four-lane divided arterial, with the State providing the estimated construction cost of $500,000.

Route 1

Charles I. Cunningham Company has a $21,500 job to install draining improvements between three miles north of Bodega Bay and 0.2 mile south of Bridgehaven.

E. A. Forde Company finished work on October 25, 1963, on the installation of 1.5 miles of underdrains in the same vicinity.

A project to build approximately 1½ miles of improved two-lane, all-paved highway on Route 1 approximately 11 miles north of Fort Ross is under construction.

Planning studies are in progress for the relocation or widening of existing Route 1 between Route 116 and 3.2 miles north of Jenner.

Other Routes

Fabian Bobo completed a $40,000 job of slide correction and installation of underdrains at Sears Point on Route 37 on June 6, 1963.

Survey maps have been received and design studies are underway for freeway development on Route 121 between Sears Point and the Napa county line. The portion of this route between Route 12 and the county line is being designed as an initial two-lane expressway.

The sum of $200,000 has been budgeted for correcting the failing timber-steel retaining wall approximately 1.6 miles west of Guerneville on Route 116.

Plans are complete and design studies are in progress for the construction of the portion of Route 116 between Austin Creek and Monte Rio (Big Bend) to a two-lane conventional highway.

STATUS OF DISTRICT IV—FREEWAY AND EXPRESSWAY PROJECTS

April 1964

New route	Description	Total miles	Completed projects		Under contract		Budgeted		Right-of-way expended and budgeted
			Miles	Construction cost	Miles	Construction cost	Miles	Construction cost	
IS 80	Central Freeway	1.8	1.8	$11,653,000					$8,533,099
IS 80	San Francisco to Carquinez Bridge (portions)	18.2	18.2	[d]62,260,000		$1,075,000		$690,000	13,416,836
IS 280	Junipero Serra Freeway; from Bayshore Freeway (SSR 101) in San Jose to San Francisco county line	47.4	4.7	6,161,000	8.0	14,727,000	13.0	[i]9,150,000	52,844,252
	Park Presidio Freeway; from Golden Gate Bridge to Fulton Avenue	2.1	1.2	1,448,000					2,582
IS 480	Golden Gate Freeway; from Embarcadero Freeway to Golden Gate Bridge	3.3							57,431
	Embarcadero Freeway	1.5	1.5	14,842,000		1,531,000			12,485,452
IS 580	MacArthur Freeway; distribution structure to Castro Valley	15.3	6.8	15,910,000	6.0	23,873,000	2.5	*6,360,000	65,393,501
	Castro Valley to San Joaquin county line	31.8	31.4	11,647,000	0.9	1,500,000	0.4	1,350,000	5,706,276
IS 680	Nimitz Freeway; from Bayshore Freeway to Warm Springs (Route 17)	8.9	8.9	4,435,000					883,608
	Warm Springs to IS 580 (US 50)	17.7	4.7	6,200,000					3,736,509
	IS 580 (US 50) to Walnut Creek	16.0	3.5	3,010,000	9.3	[h]19,379,000	5.8	[j]4,700,000	12,811,978
	Walnut Creek to Monument	3.4	3.4	9,322,000					6,415,451
	Monument to Solano county line	7.4	5.4	[e]15,716,000	2.0	1,829,000			4,077,442
Route 1	Cabrillo Highway; from south of Watsonville to 4 miles south of Davenport (portions)	22.8	16.8	[g]8,878,000	5.0	2,700,000			3,857,160
	Moss Beach to San Jose Avenue at Route 82 (portions)	17.8	5.4	2,804,000	4.1	5,453,000			10,405,438
4	Arnold Industrial Freeway; from Hercules to Antioch Bridge	34.1	14.7	4,737,000			5.0	7,800,000	2,270,705
12	Sebastopol to Kenwood	17.7			4.1	5,200,000		200,000	6,196,225
	Kenwood to south of Sonoma at SSR 121	14.0							
	From SSR 29 to Solano county line	3.3							
13	Warren Boulevard Freeway; from SSR 24 near Lake Temescal to MacArthur Freeway	5.6	3.1	[f]5,681,000	1.2	1,892,000	1.3	1,845,000	1,270,461
17	From Santa Cruz to San Jose (portions) at IS Route 280	16.4	16.4	17,868,000					9,824,761
	From IS Route 280 at Moorpark Avenue to Warm Springs via Alum Rock Road	18.3							
	Connection from 17 to 680	4.4							581,303
	Nimitz Freeway; from Warm Springs to distribution structure	33.8	32.4	56,401,000				347,000	21,569,410
	From IS 80 near Albany to SSR 101 near San Rafael	9.9	2.2	1,973,000		19,000			2,685,250
24	Grove Shafter Freeway; from Nimitz Freeway (SSR 17) to Warren Boulevard Freeway	4.8							13,898,312
	From Warren Boulevard Freeway to Walnut Creek	11.0	6.4	9,860,000	4.6	22,834,000		1,295,000	1,521,846
29	From Solano county line to Calistoga (portions)	36.9	25.4	6,328,000				22,000	4,334,649
37	From SSR 101 at Ignacio to Solano county line	9.7	6.3	4,811,000					572,986

STATUS OF DISTRICT IV—FREEWAY AND EXPRESSWAY PROJECTS—Continued

April 1964

Route	Description	Total miles	Completed projects		Under contract		Budgeted		Right-of-way expended and budgeted
			Miles	Construction cost	Miles	Construction cost	Miles	Construction cost	
61	Bay Farm Island Bridge and approaches	0.6	0.6	2,062,000					165,033
	Webster Street and Posey Tubes	1.1	1.1	18,666,000					2,732,779
77	Shepherd Canyon Freeway; from Warren Boulevard Freeway to SSR 24 in Lafayette	10.3							663,009
82	Southern and Southern Embarcadero Extension Freeway; from SSR 1 at San Jose Avenue to SSR 87 near Army Street (portions)	5.3	1.5	[b]16,938,000	3.8	16,488,000		185,000	33,102,428
84	From east of IS 280 to west end of Dumbarton Bridge	6.4							546,386
	From 2.6 miles east of Dumbarton Bridge to SSR 238 at Niles	5.7							
	From IS 680 near Sunol to IS 580 near Livermore	9.7							
85	West Valley Freeway; from SSR 101 south of San Jose to SSR 17	10.0							821,548
	From SSR 17 to Bayshore Freeway (SSR 101) at Mountain View	13.6			5.5	6,669,000			7,118,978
87	Guadalupe Freeway; from Bayshore Freeway (SSR 101) to West Valley Freeway (SSR 85)	9.5							
92	19th Avenue Freeway; from Junipero Serra Freeway (IS 280) to Alameda county line at San Mateo Bridge (portions)	8.0	2.3	4,800,000				225,000	7,635,758
	From San Mateo county line to Nimitz Freeway (SSR 17)	6.8					3.0	3,500,000	1,146,487
101	San Benito county line to Ford Road south of San Jose	27.9	5.8	1,093,000					545,839
	Bayshore Freeway; from Ford Road to Southern Freeway in San Francisco	52.9	52.9	[a]60,864,000		2,037,000		1,155,000	29,006,801
	James Lick Memorial Freeway	3.0	3.0	11,445,000					12,870,844
	Redwood Freeway; Golden Gate Bridge to Mendocino county line	84.3	69.0	[c]52,817,000	9.0	11,421,000	1.1	1,907,000	20,826,416
114	West of SSR 82 to Bayshore Freeway (SSR 101) in Redwood City	1.1			1.1	[b]2,250,000			2,842,075
121	From SSR 37 near Sears Point to SSR 29 in Napa at Imola Avenue	16.8	1.1	1,124,000					123,885
152	Pacheco Pass; from 1 mile east of Bells Station to Merced county line	5.3	5.3	1,702,000					12,393
186	Sweeney Ridge, west of SSR 35, to Bayshore Freeway (SSR 101)	4.0							2,111,323
237	Mountain View-Alviso Freeway; from El Camino Real (SSR 82) to Nimitz Freeway (IS 680)	10.5	5.5	2,088,000	2.2	1,715,000			2,223,445
238	Freeway Connection from Nimitz Freeway to MacArthur Freeway (IS 580)	2.2	2.2	2,803,000					2,236,852
242	North of Monument in Pleasant Hill to SSR 4, Concord	3.4		226,000	3.2	3,150,000			1,940,405
		733.7	370.9	$458,573,000	70.0	$145,752,000	32.1	$40,731,000	$394,025,607

* Advertising of project depends on coordination with S.F.B.A.R.T.D.
[a] Includes $500,000 contributed by cooperating agencies.
[b] Includes total of $1,600,000 by City of San Francisco.
[c] Includes total of $5,000,000 by Golden Gate Bridge and Highway District.
[d] $29,117,000 Toll Bridge Funds in this amount.
[e] $6,833,000 from Toll Bridge Funds.
[f] City of Oakland and Alameda County contributions included in this figure.
[g] Includes $690,000 by District V.
[h] Includes total of $1,051,000 by City of Redwood City.
[i] County of Alameda contribution included in this figure.
[j] Remaining portion to be financed in 1965–66 fiscal year.

New 70 mph Speed Zones

It is legal now to drive 70 miles per ur on five freeway stretches of Cali- rnia highway, totaling 120 miles.

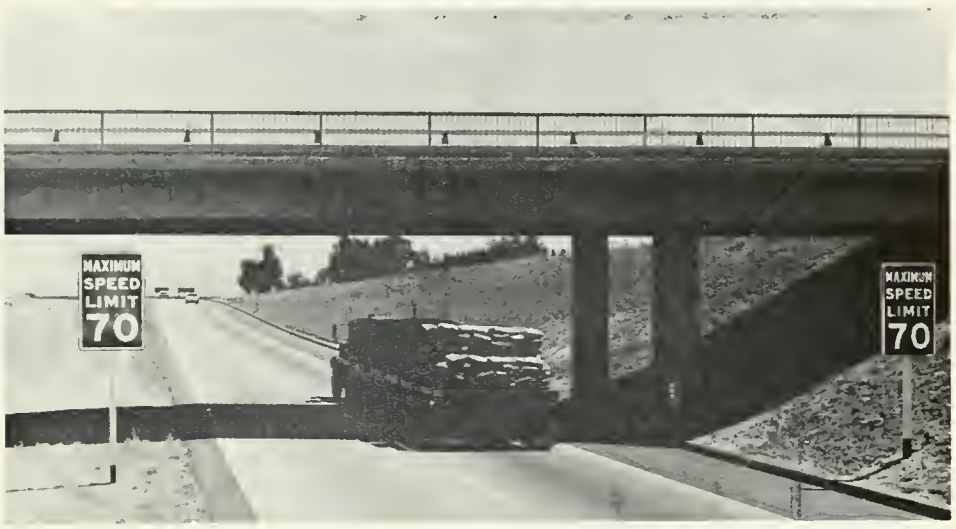
The first exception to California's rmal 65-m.p.h. maximum was a 47- le stretch of Interstate Route 15 in e desert east of Baker, San Bernar- no County.

A little later, three sections of Route and a section of Route 101 were sted for 70 miles an hour.

The locations on Route 99 are: a -mile stretch between Sacramento d Lodi; south of Tulare, 25 miles; the vicinity of Bakersfield, 11 miles. n Route 101, the section is north of nta Rosa, 10 miles. Other sections freeway are being investigated to termine if conditions are suitable for -m.p.h. speeds.

Robert B. Bradford, Administrator Highway Transportation, warned otorists that the higher speed limit these carefully selected stretches of eeway, permitted under legislation acted in 1963, is still regarded as perimental.

"Safety is always our first concern," said. "These locations were disig- ted after careful surveys and consul- tion between the Division of High- ays and the California Highway trol. They agree that the higher aximum speed is consistent with safety in these cases. The burden of proof remains, of course, with the individual motorist."



Southbound traffic on the Route 99 freeway just south of Bakersfield enters one of the state's first 70-m.p.h. maximum speed limit zones just north of the Planz Road overcrossing.

Commissioner Bradford M. Crittenden of the Highway Patrol also emphasized the role of the motorist, indicating that the establishment of additional zones will depend on how drivers react.

"We intend to watch driver behavior patterns in the new zones very carefully," he declared. "Our experience with these first five will be a strong factor in our recommendations regarding future extension of the higher speed limits."

Crittenden also pointed out that California's basic speed law—requiring motorists to drive no faster than conditions render safe—still applies in the new zones.

"The 70-m.p.h. sign doesn't mean 70, or even 65, if traffic is heavy, or the pavement slippery or the visibility reduced," he said. "We'll be watching driver reaction in this respect also."

... Continued on page 64

Eleven miles farther south, near the junction with the former Route 99, the maximum legal speed reverts to 65 m.p.h.

Hot Springs Creek

Memo Shows Concern For Scenic Values

BRIDGE DEPARTMENT

Hot Springs Creek
Bridge No. 44-52
V-Mon-56-D
Contract 63-5T13C10

July 23, 1963

MEMORANDUM TO DESIGNERS

Mr. I. O. Jahlstrom
Operations Engineer
Attention: Design Section No. 5

The appearance of the completed Hot Springs Creek Bridge, No. 44-52,

Editor's Note: Upon completion of most bridge contracts, the resident engineer prepares a memorandum to the design staff, reporting and commenting on significant features of the project, completeness of the plans and suggestions for improvement. The memorandum on Hot Springs Creek Bridge, recently constructed in State Route 1 between Big Sur and Lucia on the Monterey County Coast, is published to illustrate this type of report and to indicate how engineer-contractor teamwork and awareness of scenic values can serve the public purpose most effectively.

Published on another page is a copy of a memorandum to W. S. Ludlow, Bridge Architectural Senior, from Senior Bridge Engineer M. B. O'Gara (head of Design Section 5), summarizing design features of the project.

Precast, prestressed concrete girders were used in the new 360-foot bridge across Hot Springs Creek canyon on State Route 1 in the Big Sur area sou of Carmel.

view of the Hot Springs Creek Bridge from the streambed. To minimize disturbance to native shrubbery and for economy, the structure is supported on single, six-foot round column pier shafts mined into the rock of the steep canyon slopes.

ould suggest a considerable step had en accomplished toward economical hievement of more harmonious enic values in the area.

Contractor G. S. Herrington appar-tly gave much consideration, as evi-nced by several exploratory conver-tions with the Bridge Department epresentative, to the problem of se-cting Alternate "A," the prestressed rder design, or Alternate "B," the ox girder design.

Herrington stated that in view of e fact that the length, section and eight of the prestressed girder speci-ed was the absolute maximum, and rhaps slightly more than the maxi-um. that could be moved over the tervening highways from a properly uipped casting base, it would seem at the box girder design might be e preferable risk if not the more onomical. He stated that his calcu-tions revealed no difference in esti-ated comparative costs between the o alternates.

Mr. Herrington finally stated that e deciding factor that motivated his lection of Alternate "A," the pre-ressed girder design, was the deeply trenched feeling of the residents of e area against such construction op-ations on this scenic route as tend leave unsightly scars on the terrain damage the natural growth. The reparation of adequate bearing and e erection of falsework necessary to ox girder construction on the steep

DIVISION OF HIGHWAYS

MEMORANDUM

To: Mr. W. S. Ludlow

From: Mr. M. B. O'Gara DATE April 28, 1964

SUBJECT: Hot Springs Creek Bridge

This four-span 360-foot structure spans the 100-foot-deep Hot Springs Creek Canyon. The design attempts to preserve the scenic values of the site 50 miles south of Carmel in the Big Sur area of the Monterey coast. The project featured alternative designs giving the contractor options of precast prestressed girders continuous for live load or cast in place concrete box girder superstructures.

The low bidder, G. S. Herrington, elected to the construct the precast prestressed option. The girders were manufactured by Basalt Rock Company of Napa.

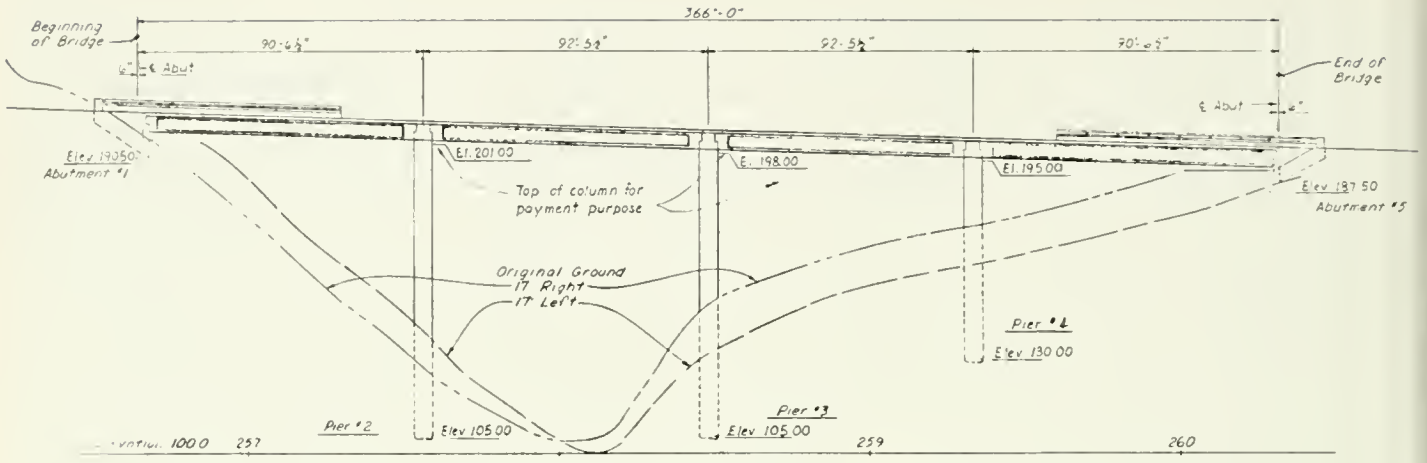
To minimize the disturbance to the native shrubbery and for economy on the steep canyon slopes, the structure is supported on single six-foot round column pier shafts mined into the rock, in lieu of footings.

Concealed wedge-shaped caps permit the use of constant-length girders, despite the curved alignment, and preserve the clean lines of the superstructure.

The recessed cap design and continuity of the deck slab cause the superstructure to act as a lateral beam carrying most of the lateral forces to the abutments. Monolithic construction of column and superstructure, combined with the reduced lateral forces on the columns, achieve economy in column reinforcement.

Designed by K. H. Johnson. Checked by W. T. Egloff.

M. B. O'GARA



A profile of the bridge showing overall length of the bridge, length of each span and elevation of the piers.

slopes of the site would have left such scars and have caused considerable damage to natural growth. The sincerity of the contractor in his efforts to consider the artistic sensibilities of the local residents was borne out in the nature of his carefully planned and executed construction operations.

In view of the absence of a stated position concerning the subject in the special provisions, the selection of prestressed girder construction was also predicated on permission to place the girders from the deck of the existing bridge. It developed that such an operation would necessitate the imposition of two 40- to 50-ton-capacity cranes carrying a cantilevered girder load of 72 kips or a total dead load of approximately 300 kips (300,000 pounds) on the old structure while placing each girder of the center two spans on cap-supported dollies for final positioning.

After thorough inspection of the existing structure with special attention to the nature of previous extensive repairs, it was decided that such load imposition constituted a reasonable risk and the requested permission was granted, with the qualifying provision that the contractor operate only with each of the two cranes positioned over separate bents and that he be prepared to cease the operation and devise another method of placing the girders should the engineer determine at any time that the existing bridge was showing evidence of impending failure.

Foundations

Abutment 1 spread footing was founded entirely on weathered base rock at planned elevation. Abutment 5 spread footing was founded on sound base rock largely at planned grade. A portion of the left footing step of abutment 5 was excavated to something less than one foot below planned grade to achieve same bearing value as was apparent at right of center line. Portion of retaining wall footing at left of abutment 5 was also deepened slightly to achieve uniform bearing in cemented sands and gravels.

Single six-foot-diameter column at each bent was designed to extend into excavation of such direct and transverse bearing values as to preclude the need of spread footings. Necessary point bearing values were accomplished by establishment of the lower end elevation in base rock at or near planned grade. Bent 4 column was transversely supported by lower two feet in base rock and next 28 feet in cemented sands and gravels interspersed with large sound boulders. Approximately 30 feet of column 4 is below original ground as compared to approximately 35 feet exposed. Columns 2 and 3 are founded in 23 and 24 feet of base rock respectively as compared to approximately 74 and 70 feet of respective exposure.

Methods

Excavation in base rock for columns 2 and 3 was accomplished to sound undisturbed material for both direct and transverse bearing and with a comparatively small overexcavation by the following methods: Drilling and shooting was accomplished in increments of two feet of column length by use of a circle of holes drilled vertically at 2'4" radius and approximately 1'8" apart and a concentric circle of four holes at 1'0" radius and tapering progressively toward the center as drilled. All holes were loaded with one-half stick of 40 percent dynamite in the bottom and one-half stick in the upper foot of hole. The inner circle of tapered holes was then timed to explode just ahead of the outer circle of vertical holes. Thus the center was loosened ahead of the main charge resulting in the major portion of the main charge being directed toward the center. The net result was a minimum of air hammer excavation beyond planned excavation limits to effect removal of all shattered or disturbed material.

The approximately 5'3" clear diameter inside the column rebar cage was the minimum that would permit a standard 1-cubic-yard concrete pour bucket to be lowered to the bottom of the cage and tripped by an operator riding on the bucket. This procedure allowed the placement of lower slump concrete than could be poured through boots or tubes, thereby eliminating the danger of segregation and permitting a faster pour with less danger of form failure.

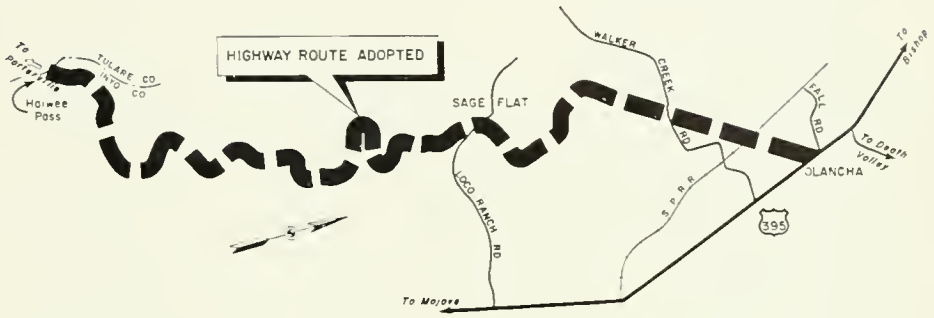
E. A. Campbell
Bridge Department
Representative

New Routes

Highway Commission Adopts 50 Miles of New Freeways

The California Highway Commission adopted nearly 50 miles of freeway routings at its March meeting, including two sections totaling 13.5 miles on State Sign Route 49, the "Mother Lode Highway," north and south of US 50 west of Placerville in El Dorado County.

The other freeway routings were for a 26-mile stretch of US 99 (future State Route 86) extending southerly from the Riverside county line in Imperial County, and a 9.7-mile section of US 395 in Lassen County between Long Valley Creek Bridge and 1.2 miles north of Doyle.



Conventional Routing

Additionally, the commission adopted in April a 14.3-mile conventional highway routing for State Highway Route 127 (future State Route 190) in Inyo County. The adopted section is between US 395 near Olancha, about 24 miles south of Lone Pine, and Haiwee Pass at the Tulare county line.

The commission chose the "A" alternate for the northern portion of SSR 49, extending southeasterly between one-half mile northwest of the bridge across the South Fork American River and US 50 west of Placerville, and the "AB" combination extending southerly between US 50 at Perks Corner and 5.7 miles north of the Amador county line.

Choices Recommended

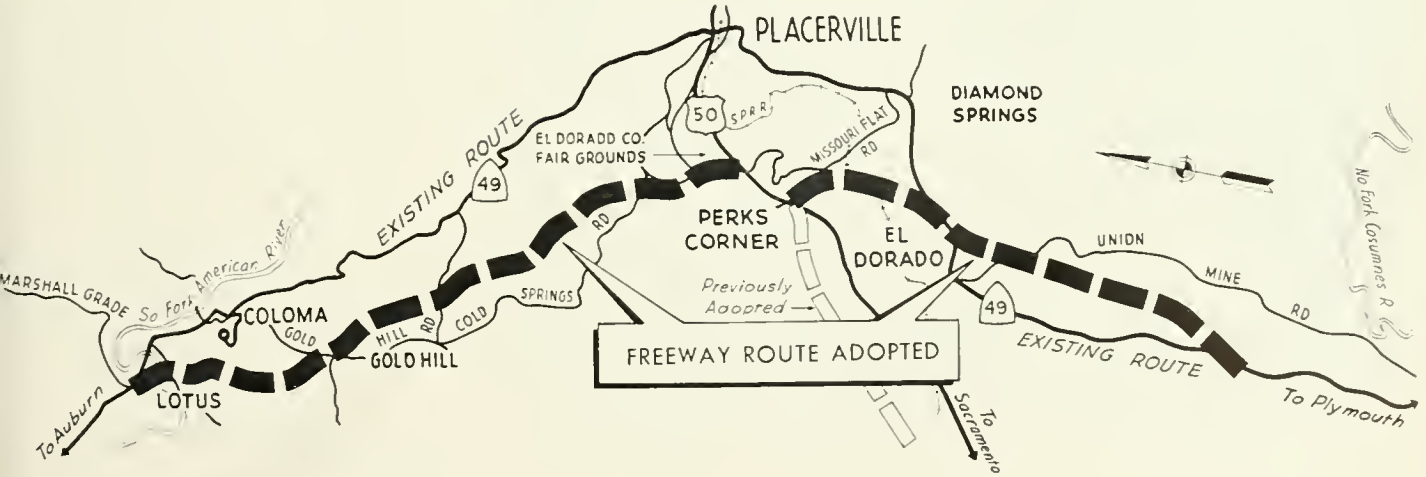
The choices were recommended by the State Highway Engineer, who described the "A" line as bypassing residential and recreational areas and as not conflicting with Gold Discovery Site State Park, and the "AB" combination as offering the least conflict with the existing highway which local citizens wish maintained as a scenic and historic route.

The adopted route for the US 99 Freeway in Imperial County follows the existing alignment of the present highway. The adopted US 395 Freeway section in Lassen County generally follows the existing highway except near Doyle, where it passes west of the business district.

Rugged Terrain

The newly adopted trans-Sierra route in Inyo County, future State Route 190, will traverse extremely rugged terrain varying from an approximate 3,800-foot elevation at Olancha to 8,200 feet at Haiwee Pass. It eventually will be extended westward to join SSR 190, now constructed east of Porterville in the San Joaquin Valley to Quaking Aspen Camp in the Sierra Nevada.

In another March action, the commission adopted a realigned routing for 0.6 mile of SSR 132, a conventional highway in Stanislaus County, about three miles east of Waterford, to ease sharp curves.

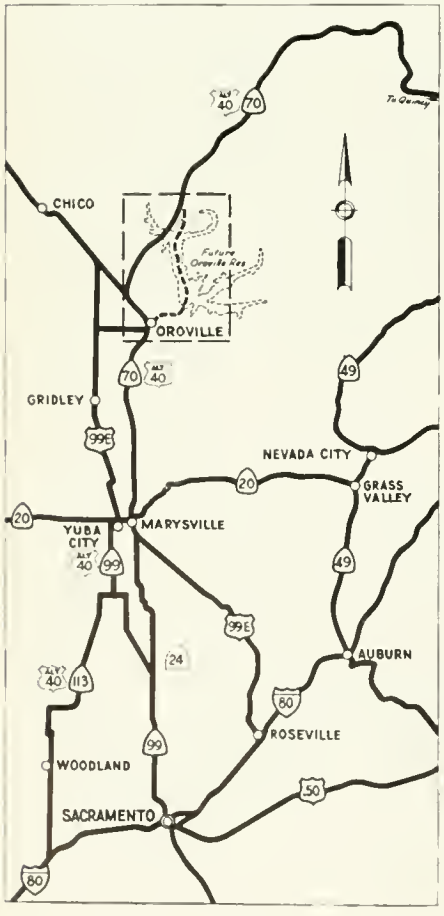


Oroville Relocation

By ALAN S. HART, District Engineer

With the completion of the 6½-mile freeway between Oroville and the junction to the north known locally as Wicks Corner, the final section was opened in the relocation of nearly 20 miles of State Sign Route 70 (old US 40-Alt.) around the Butte county seat.

The new route replaces the old Feather River Highway, between Oroville and Jarbo Gap, which will be flooded when Oroville reservoir begins to fill after completion of the dam. It was built under four contracts totaling some $19,000,000 and is about a mile shorter than the scenic but winding and narrow old road.



Adopted by the Highway Commission in 1956, the new route (see map) begins in Oroville at the west end of Montgomery Street, crosses the Feather River and runs through the area known as Thermalito, and then travels northwesterly roughly parallel to a section of the old Oroville-Chico road which will be relinquished to local agencies for maintenance.

Ascends Into Sierra

At Wicks Corner it swings northeasterly to gradually begin its ascent into the Sierra. The route crosses the West Branch of the North Fork of the Feather River over a steep canyon at Vinton Gulch. Between the West Branch and Jarbo Gap, it generally parallels the Oroville-Concow county road via Yankee Hill.

The relocation was done under a cooperative agreement with the Department of Water Resources which financed a portion of the construction from legislative appropriations as a "replacement in kind" of the former highway. Highway funds were used to the extent that the new highway is an improved facility compared with the old.

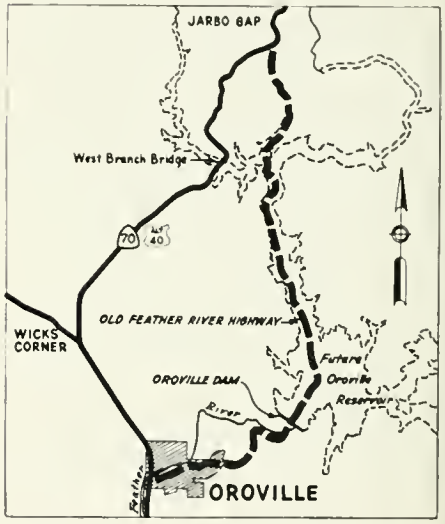
The old Feather River Highway, or the Oroville-to-Quincy road, which totaled about 78 miles, was spectacular both as an engineering feat and a scenic wonder. It was literally carved out of solid rock. Of the 7,710,000 cubic yards of excavation which preceded the surfacing of the 71 miles to Keddie, 85 percent was rock.

Original Highway

This original highway followed an old narrow, tortuous road which was once only wide enough in some places for a single wagon at a time. It was an early access to the rich timber lands and mineral deposits in Plumas County and was originally surveyed in 1867 by pioneer engineer Arthur Walter Keddie.

By the turn of the century, the Western Pacific railroad had begun to push through to the west via Beckwourth Pass, and by 1909 trains were in operation over the Sierra through the winding North Fork Canyon.

The people of the mountain area—mainly Plumas County—soon sought a practical motor vehicle route to end their near isolation from the valley and to connect the county seats of Butte and Plumas Counties.



Highway crews began surveying in 1919 for a feasible alignment, and nine years later the project was ready to go, it already having been determined that the entire route would have to be completed before it could be opened to the public.

By June 1928 two convict labor camps had been set up—one in each of the two counties—and were to supply more than half the labor for the entire project.

First Link Completed

The first link, from Oroville to the site of the highway bridge about four miles easterly, was completed in 1930.

View of expressway running out of the valley toward Jarbo Gap.

After a nine-year construction period, the route was dedicated during a three-day celebration in Oroville, Quincy, Reno, and Portola in August 1937.

The early location of the railroad along the sides of the North Fork Feather River canyon made it necessary for highway engineers to build the road on the opposite slope, creating a crisscross pattern of highway and tracks. The highway crosses the river six times in the canyon; at Pulga the highway bridge leapfrogs over the rail span, and at Tobin the road bridge passes beneath the railroad structure.

Extensive historical material and photographs on this old route that some said could never be built can be found in *California Highways and Public Works* for May 1930, June 1930, January 1932, March 1936, and especially August 1937.

Need for New Route

With the decision to build the Oroville dam, a new route had to be found and most of it placed in operation before work on the dam could start. Site of the dam is across the canyon just upstream from that first highway bridge east of Oroville.

The first section of the new route around the other side of Oroville was

Beginning of relocated old U.S. 40-Alternate (new State Sign Route 70) immediately west of Oroville. Interchange in foreground is at Oroville Dam Boulevard and farther north at the west end of Montgomery Street. Bridge across Feather River also visible. Old road parallels freeway at right.

Typical view of the Oroville-Wicks Corner freeway. This one is approaching the Grand Avenue interchange in Oroville from the south, located about one-half mile north of the Feather River.

Looking westerly from typical section of expressway coming down into the Sacramento Valley. Turnoff at right is State Sign Route 191 to Paradise.

typical view up the narrow North Fork Feather River Canyon. Old road upper left, abandoned railroad lower right. All will be inundated when reservoir is full.

ction of old Feather River Highway, now closed to traffic since opening of relocated route. About half the former road was built by convict labor and completed in 1937.

Another view of a typicol stretch of relocoted highway, a little forther up the line than the upper photo on page 57.

ontract for 13.75 miles of two- and ır-lane expressway from Wicks rner, elevation 300, in the valley to bo Gap at elevation 2,330.

This $8,550,000 job included grad- about 2.7 miles of Western Pacific dbed where the relocated railway alleled the new highway in the vi- ity of Vinton Gulch on the North rk. This action permitted use of the plus material excavated from the road right-of-way as embankment the adjoining highway, resulting a substantial saving on the overall ject.

Also included in this contract was nstruction of a 1,285-foot siphon—a lded steel 42-inch pipe which car- s the Upper Miocene canal across a yon and under the highway.

West Branch Bridge

The second phase was construction the West Branch bridge at Vinton lch at about the middle of the icks Corner-Jarbo Gap expressway. e double-deck structure consists of ır steel truss spans on massive con- te piers towering 450' feet from bottom and sides of the canyon.

Top deck of the $8,600,000 bridge ries four traffic lanes and the lower el supports a single set of Western cific tracks. The impressive struc- e was dedicated and opened to ffic in gala ceremonies in August 52.

A detailed construction article ap- ars in *California Highways and Pub- Works*, May–June 1962.

A third contract was completed for proaches and minor repairs to the hway at the time the bridge was ened to traffic.

Comprehensive articles concerning s project as well and the overall ocation appear in *California High- ys and Public Works* for May–June 7 and September–October 1957.

Final Section

Final section was the four-lane full eway from Oroville to Wicks Cor- which was accepted from the con- ctor in January 1964. This $3,800,- job included an interchange at ntgomery Street in Oroville, a dge across the Feather River, two ier interchanges northwest of Oro-

Reverse view of lower photo on page 57. Feather River bridge in foreground with Montgomery Street interchange immediately adjacent. View is to the south.

Fifteen-foot arch culvert under embankment about one-third of the way between Wicks Corner and Jorbo Gap.

Aeriol of the Gorden Avenue interchange about one mile northwest of Oroville. The old Oroville-Chico road is ot right as is o loop of the relocated Western Pacific railroad. Wicks Corner in upper center background.

Aeriol of completed Wicks Corner intersection. Old road is ot right. Freewoy makes transition from four tones to two and continues toward Gorbo Gap os on expresswoy. Road ot left goes to Chico.

Construction photo shows old and new alignment ot Wicks Corner. Relocated highway turns to the right. Rood ot left goes to Chico.

Aeriol shows four-lone section northeost of the West Bronch bridge.

le (Thermalito), and numerous ıaller structures.

A fifth project, not a part of the operative agreement between the vision of Highways and Depart-ent of Water Resources, was built uth of Montgomery Street and fi-nced entirely by state gas tax funds.

This two-mile project relocated the uth approach to Oroville through e old dredger tailings between the rmer road and the Feather River. ıe new alignment provides a straight ot connection to the Montgomery reet interchange while at the same ne bypassing a congested condition ong the built-up area fronting the rrow old road.

At the present time a planting con-ıct is nearing completion along e Oroville-Wicks Corner Freeway hich calls for the establishment of ees along the right-of-way.

Contractors and state resident engi-ers were as follows:

Wicks Corner to Jarbo Gap—The int venture firm of McCammon-Vunderlich Co. and Wunderlich Con-acting Co. was contractor, and Mul-r Chapman was resident engineer.

West Branch bridge—Stolte, Inc., ıd Morrison-Knudsen, Inc., a joint enture, was contractor, and P. C. larris resident engineer.

West Branch bridge approaches—aldwin Contracting Co., Inc., and erry Lowden, Jr.

Oroville to Wicks Corner—Harms ros. and Lord & Bishop, Inc., a joint enture, and Darrel McWhirk.

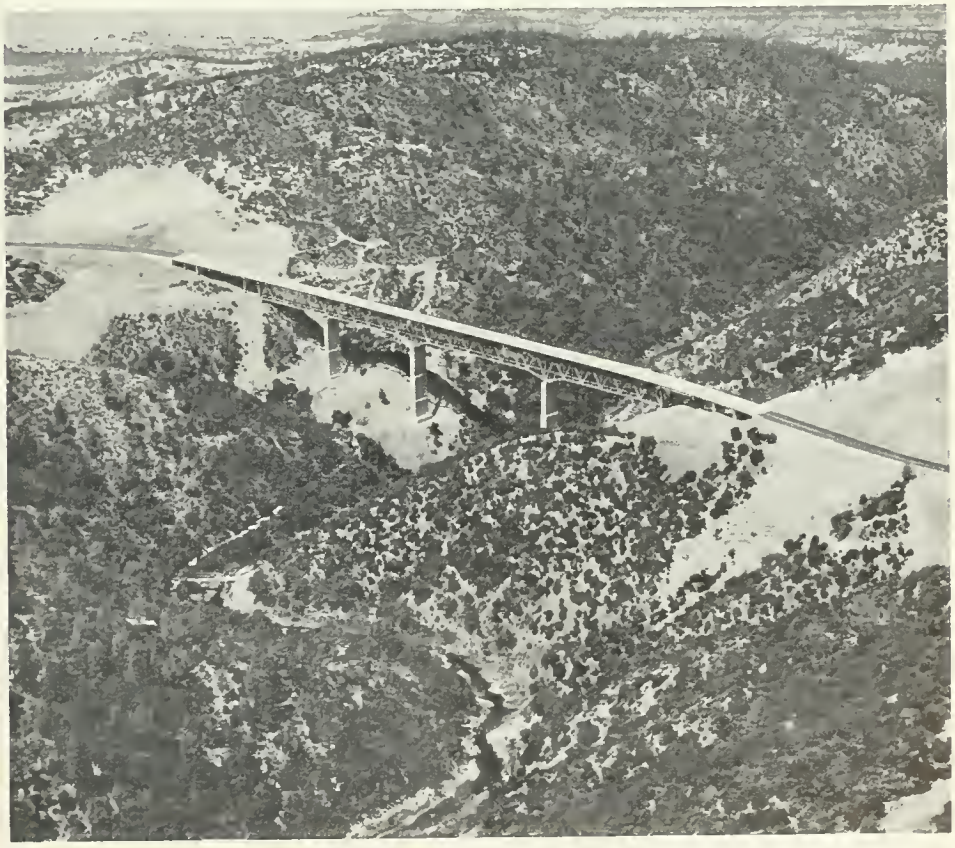
South of Montgomery Street proj-ct—Harms Bros., Inc., and John E. Gentz.

Oroville to Wicks Corner planting Frank M. Smith, contractor, and ndy Drum, resident engineer.

TUNNEL RENOVATION

The State Division of Highways has alled for bids on the renovation of ıe existing two-bore Caldecott Tun-el in Alameda and Contra Costa Counties. In order to best serve com-ıuters, the renovation will begin only fter the new westbound Caldecott Tunnel bore is opened to traffic some-ime in September.

Shows details of bridge construction prior to completion. Total structural steel, 11,000 tons; concrete, 40,000 cubic yards.



General view of the West Branch bridge over Vinton Gulch. Old county bridge on the Oroville-Concow Road visible lower left. Top deck is four lanes, lower deck carries single railroad track. Water will be a maximum 350 feet deep, or 8 feet from top of piers.

British Transport Minister Revisits Freeways

Right Honorable Ernest Marples, second from left, Great Britain's Minister of Transport, is shown on his latest visit to California, where he inspected highway projects and conferred with highway officials in late April and early May. In this picture, he is being shown one of the current construction projects on Interstate Route 10 (Santa Monica Freeway) by District Engineer E. T. Telford (left) and Senior Resident Engineer J. D. Hetherington (right). Mr. Marples' private secretary, Trevor Lawmon, is between him and Hetherington.

Mr. Marples' first stop in California was in the San Francisco area, where he inspected construction activities and equipment on Interstate 580 Freeway in Oakland under the guidance of Deputy District Engineer Haig Ayanian.

New Speed Zones

Continued from page 51 . . .

State Highway Engineer J. C. Womack said every effort would be made by the Division of Highways to mark the beginning and end of each 70-m.p.h. zone clearly, so as to avoid motorist confusion.

At the beginning of each zone there will be 70-m.p.h. signs on both sides of the roadway, and a similar dual installation of "End 70 Mile per Hour" at the end of each zone. There will also be 70-m.p.h. signs along the right shoulder at intermediate points. Other signs, in the median strip, will direct slower traffic to keep right.

To reinforce the "End 70 Mile per Hour" signs, the Division of Highways will also install signs reading "Maximum 65 Miles per Hour" about 800 feet past the end of the zone.

The 1963 law provides the Administrator of Highway Transportation may declare the higher maximum speed on a section of freeway on the basis of engineering and traffic surveys indicating that "a speed greater than 65 miles per hour would facilitate the orderly movement of traffic and would be reasonable and safe."

The Division of Highways will consider only rural freeways for the higher maximum, according to Womack. The division's other criteria, which must be met before the location is even discussed with the Highway Patrol, include: adequate width; traffic volume light in relation to capacity; accident rate below average for rural freeways; well-spaced interchanges; minimum continuous length, 10 miles.

If a section of freeway meets these standards, the district engineer of the Division of Highways confers with the area commander of the California Highway Patrol. If the latter is in agreement, the Division of Highways then conducts a detailed traffic study, including average daily and peak hour traffic flow, including percentage of trucks; accident and fatality rates; at least two speed surveys; and examination for visual obstructions, steep inclines or sharp curves.

'Tempus Fugit' Corner

he following items appeared
5 years ago in *California*
ighways and Public Works:

une 1939—Arroyo Seca Parkway

Construction of California's first
eway—the six-lane, nine-mile Ar-
vo Seco Parkway connecting down-
wn Los Angeles with Pasadena—is
ll underway. From the Figueroa
eet tunnels in Los Angeles to Broad-
y and Glenarm Street in Pasadena,
t a single stoplight, intersecting
eet, nor railroad grade crossing will
encountered. The raised divider
ip will make it impossible to make
t turns across traffic or to meet op-
sing traffic "head on."

For much of the distance between
enue 22 and Hough Street near the
uth city limit of South Pasadena, the
rkway is located adjoining and par-
el to the Arroyo Seco Channel,
hich is paved and walled for the
tire distance. Since adjoining prop-
y follows through Los Angeles
rk lands for a considerable portion
the distance, a large number of citi-
ns will drive through the beautified
rk areas daily.

More than 170,000 cubic yards of
cavation from the Los Angeles River
d, which had been excavated by the
S. Engineering Department in con-
ction with their channel lining proj-
t on Los Angeles River, was used
r embankment.

Design and construction of this free-
y is receiving closest cooperation
tween the State, Cities of Los An-
les, Pasadena and South Pasadena,
e various railroads involved, and
deral agencies. Construction or par-
l reconstruction of 16 street and
lroad bridges crossing over the free-
y is involved, and the project will
compass seven different contracts at
otal estimated cost of $3,745,000. Ex-
nsive landscaping has been planned
the Cities of Pasadena and South
sadena in cooperation *with* the State,
d at no cost *to* the State.

It is anticipated that the average
iving time between the two cities
ill be reduced one-half, which esti-
mate is not based on excessive speeds,
but rather on the continuous flow of
traffic without the interruption of in-
tersecting streets and railroads. (The
Arroyo Seco Parkway was dedicated
by Governor Culbert L. Olson on De-
cember 30, 1940.)

* * *

The lead article in the June 1939
issue concerns toll rate reductions on
the San Francisco-Oakland Bay Bridge.
A transaction was effected which re-
sulted in a 20 percent toll saving for
motorists: 40 cents per auto instead
of 50 cents.

* * *

T. E. Ferneau, Resident Engineer
on the Presidio (Funston Avenue)
Approach to the Golden Gate Bridge
reports a speed-up of work on the
project which extends from Lake
Street to the Marina approach to the
Golden Gate Bridge.

A unique feature of the work is the
1,300-foot four-lane tunnel being con-
structed by the open cut and backfill
method. (The approach was dedicated
and opened to traffic April 21, 1940.)

Twenty-five-year List

The following employees received
their 25-year awards since the Janu-
ary–February issue of the magazine:

DISTRICT I
Richard G. Day
Ernest Lee La Mastus

DISTRICT II
Ruth C. Hardman
Margaret E. Weaver

DISTRICT IV
June M. Brush

DISTRICT V
John W. Horn

DISTRICT VI
Lawrence H. Vance

DISTRICT VII
Abner M. Beard
Sunmy L. Lytken
John W. Shaver

DISTRICT X
Leonard C. Jones

Baxter, Hill Trade Headquarters Posts

State Highway Engineer J. C.
Womack has announced shifts in as-
signments for two of his top staff
members. Effective June 1, 1964, Frank
E. Baxter, assistant state highway en-
gineer—planning, traded positions with
George A. Hills, assistant state high-
way engineer—administration.

The primary reason for the shift in
assignments, Womack said, is to
broaden the experience of the two
engineers involved and thus strengthen
the overall administration of the Divi-
sion of Highways. Both men have had
many years of service with the divi-
sion, including assignments in various
districts and Headquarters depart-
ments.

Baxter has been in charge of the
functions associated with highway
planning since January 1962. These
activities include advance planning,
design, traffic, urban planning and
programs and budgets.

Before his advancement to assistant
state highway engineer, he had served
as maintenance engineer for six years.
His earlier assignments with the divi-
sion, starting in 1930, included service
in the Fresno and Redding Districts,
and later the Bishop District, where
he was district engineer from 1954 to
1956.

Hill's area of responsibility as as-
sistant state highway engineer—admin-
istration included the functions of
office engineering, city and county
projects, systems research, service and
supply and management analysis.

Prior to his promotion to that posi-
tion in August 1963, Hill had served
as traffic engineer. Before that he had
spent several years in charge of plan-
ning and design for the Los Angeles
District. A division employee since
1937, he has also had a variety of as-
signments in the San Francisco District
and in Headquarters office in Sacra-
mento.

SACRAMENTO W-X BRIDGE

The State Division of Highways has
called for bids on constructing the
superstructure of the W-X Street
Bridge and its approaches as a part of
the future Interstate 80 through Sacra-
mento.

Merit Awards

Employee Suggestions Are Adopted by Manufacturers

The resourcefulness and ingenuity of state employees, as manifested through the suggestion program of California's Merit Award Board, pay dividends – financial and otherwise – not only throughout state governmental agencies, but on statewide, regional and even national bases.

Two Division of Highways employees have recently submitted suggestions which were subsequently incorporated into the national manufacturers' product, thereby also contributing significantly to industrial progress.

This past January, George L. Richardson, recently retired supervising highway traffic signal technician in District IV, received a certificate of award and a cash payment of $100 for proposing that a change be made in the internal wiring of automatic signal pedestrian timers (Model PT-1), in order that a "WALK" indication will not be displayed by the pedestrian timer unless the vehicle "GREEN" indication for the proper phase is being shown.

Safer Passage

This modification would result in safer passage of motorists through—and pedestrians across—intersections, and would generally improve Division of Highways service to the public.

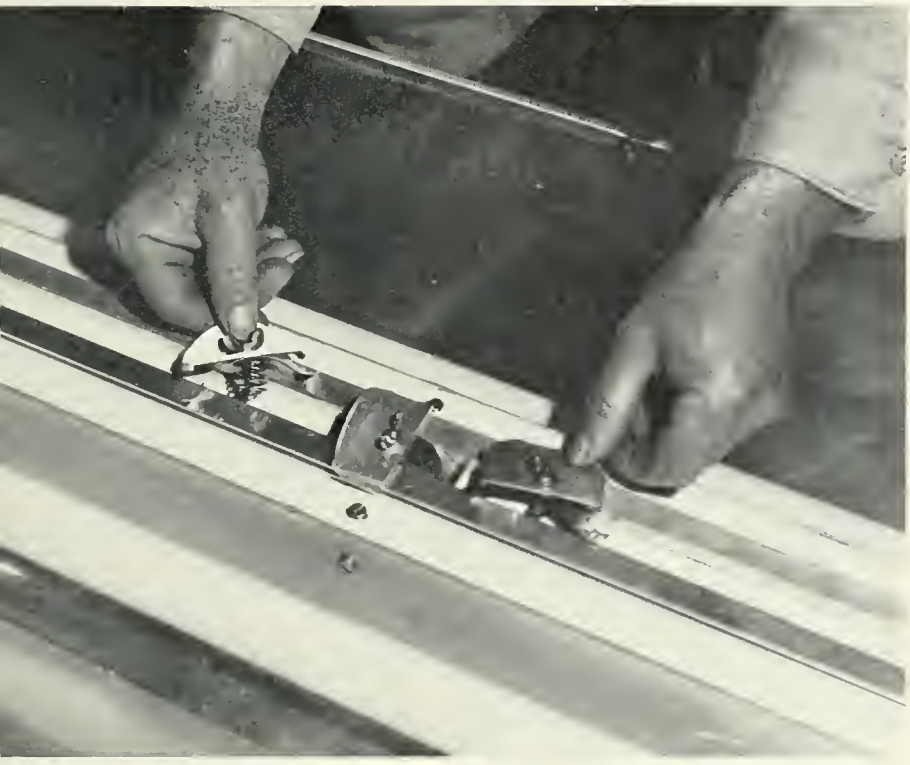
Richardson's suggestion met with approval by all districts, who felt that the conversion of all future pedestrian timers should be done at the manufacturer's level. Accordingly, the suggestion was referred to Automatic Signal of Torrance, a division of Laboratory for Electronics, Inc. Chief Engineer H. A. Wilcox, in an internal memo to District Sales Engineer Ted L. Morehead, stated, "The suggestion . . . is a good one. In fact, as the old saying goes, 'It's such a good idea I don't know why I didn't think of it myself.' We'll add this feature to our next run of units." A subsequent letter from Morehead to State Highway Engineer J. C. Womack confirmed this, adding that "this modification is 'without charge' to the State of California or any other customer. . . . We are always most appreciative of comments received through the years suggesting improvements to our equipment. . . . I will be the Automatic Signal representative at the annual maintenance meeting, and will comment favorably on Mr. Richardson's suggestion."

George T. Woodson, Highway Traffic Signal Technician of Eureka, demonstrating the use of the spring-looded clip he recommended for fastening covers on outdoor fluorescent light fixtures.

National Benefits

Since Automatic Signal has nationwide distribution, the suggestion likewise provides nationwide industrial benefits.

Similarly, George T. Woodson, highway traffic signal technician of Eureka, made a suggestion which was incorporated into the manufacturer's product with the improvement representing no additional cost.



A closeup of the spring-loaded clip shows detail of design and application.

Woodson had recommended that a ing-loaded clip be used in fastening ers on fluorescent light fixtures d in outdoor lighting. These covers previously been held in place by ans of stainless steel nuts and bolts; with Humboldt County's damp an air corrosion would take place hin a few months, and the bolts uld have to be cut in order to re- ve the cover.

The manufacturer, Electric Light- Company, Stockton, readily ap- ved and adopted the suggestion future production.

Savings Evaluated

With the resultant savings being of ngible nature, Woodson's sugges- was evaluated on the "point" tem, which rates various factors as contribute to improved pro- ures and improved safety. He was rded $30.

Eugene F. Veglia, secretary of the rit Award Board, points out that ifornia state employees submit an rage of 350 suggestions per month. cessarily these run the gamut in tent and feasibility; and range lely where monetary savings to the te are concerned. But these ap- ximate 100,000 civil servants are recognized as a wellspring of creative ideas, which benefit taxpayers locally and nationwide.

U.S. Land Funds For Two Routes

California will receive $470,000 in federal government public land funds for improvement of two roads—Salt Wells Canyon Road (State Highway Route 178, the former Route 212) and Tioga Pass Road (State Sign Route 120) near Yosemite National Park—during fiscal year 1965.

Route 178 connects to San Bernardino County Federal Aid Secondary Route 1065, one of the main roads leading to Death Valley National Monument. The $140,000 in federal funds will allow for widening the two-lane road on improved alignment for 1.8 miles, between 12.9 and 14.7 miles east of Ridgecrest. Immediately west of the federal project, a state project is underway for improvement of another 1.2 miles of Route 178, so that the overall improvements will total three miles. This $109,683 contract was awarded May 26, 1964.

The two-lane Tioga Pass Road will be improved for 3.1 miles, between the eastern Yosemite National Park Boundary and 10.6 miles west of Lee Vining in Mono County, to facilitate travel from the park to US 395.

Jacques Zeeman

Jacques T. Zeeman, 72, retired assistant chief right-of-way agent for the State Division of Highways, died in Sacramento on April 12.

Born and educated in Holland, Zeeman entered the real estate and mortgage loan business in the 1920's in Los Angeles following U.S. Army service during World War I. In 1939, he became deputy land assessor in Los Angeles County.

He started work with the Division of Highways in 1944, serving as right-of-way agent in District X, which has headquarters in Stockton. Zeeman left this position to serve first as staff appraiser for the State Board of Equalization, and later as supervising appraiser for the State Savings and Loan Commissioner in San Francisco.

Returning to the Division of Highways in 1948, this time at Headquarters Office in Sacramento, Zeeman served as real estate appraiser and supervising right-of-way agent, appraising property needed for right-of-way purposes. He was also active in the purchase of land parcels for other state agencies, including acquisition of the new State Fair site in Sacramento, Sacramento State College, Grizzly Island, the State Printing Plant site, penal institution locations, and others.

He was promoted to the post of assistant chief in 1961 to supervise all right-of-way activities in the southern half of the State, and later became administrator of the appraisal department for all valuation activity concerning right-of-way throughout California.

Zeeman was a member of the American Right of Way Association, Sacramento Chapter; the American Institute of Real Estate Appraisers, Northern California Chapter; the Sacramento Real Estate Board, and the Commonwealth Club of San Francisco.

He is survived by his wife, Marie, and a daughter.

Engineer-Geologist E. D. Drew Retires

Eldridge D. Drew, associate engineering geologist for the Division of Highways Materials and Research Department in Sacramento, has retired after a career of 31 years with the State.

Drew was born in Eureka, grew up in the Sacramento area and attended Sacramento High School. He started his state service in 1929 as an axman in District II. While working part time he studied geology and mining at Sacramento Junior College and through International Correspondence School courses.

After several years as a geologic aid with Shell Oil Company he returned to the State in 1939 and held geologic and engineering positions with the Division of Mines and the Division of Architecture.

ELDRIDGE D. DREW

Drew was appointed an assistant geologist with the Materials and Research Department in 1944 and in 1949 was promoted to associate engineering geologist. He has promoted the use of seismic and resistivity surveys in the solution of foundation problems and the design of cut slopes for many major projects in our highway construction program. He played a major role in the design of the "Big Cut" at Carquinez in Contra Costa County on Interstate Highway 80, which involved 8.5 million cubic yards of excavation. He also had a responsible part in the design of the Sepulveda Cut on the San Diego Freeway, Interstate Highway 405, in Los Angeles County involving approximately 13 million cubic yards of excavation.

The Drews have four children and one granddaughter. They will move to Grass Valley, where the Drew family pioneered in the early 1860's. Drew's wife, Marian, also retires after almost 25 years with the State as a clerk and stenographer, the last 10 years in the Attorney General's office.

Drew is a member of the Polaris Masonic Lodge No. 730 and is a 32d-degree Mason in the Sacramento Consistory of Scottish Rite.

Evan G. Bower

Evan G. Bower, 52, assistant district engineer—operations, was killed April 29, 1964, while inspecting cleanup work on the new alignment of US 91 in the Yermo area. His auto struck a cable strung between two motor graders to support one of them working on an incline.

Bower was born in Hartford, South Dakota. He came to California in 1922 and went to school in Long Beach. He graduated from the California Institute of Technology with a B.S. degree in 1933.

Bower started to work for the Division of Highways in 1934 on a survey party working out of the Los Angeles office. Except for seven months in 1936, when he worked for the federal government, and for a little over 3½ years, when he served in the U.S. Navy as a lieutenant commander, he was continuously employed by the division. He also worked in Redding, Eureka, Sacramento, and San Luis Obispo before coming to the San Bernardino office in 1956.

As assistant district engineer in charge of operations, his duties covered all phases of construction and maintenance of state highways in San Bernardino County and the western portion of Riverside County.

He has supervised the construction of many major freeway projects in the district, including Interstate Highway 40 from Barstow to the Nevada state line and Interstate Highway 10 from Colton through Cabazon, as well as many others.

He is survived by his wife, Anita, and a brother, Harrill M. Bower of Long Beach.

FREEWAYS 1,300 TIMES SAFER

If the established death rate of the 500-mile Memorial Day Classic at Indianapolis prevailed on California's public roads, 3,028,000 persons would have died in traffic accidents during 1962.

Division Announces Latest Retired List

DISTRICT II

Aubrey, Charles E., assistant highway engineer, 12 years.

DISTRICT III

Bernard, Paul E., highway foreman, 31 years.

DISTRICT IV

Mack, Wille E., highway maintenance man I, 16 years; Henderson, Ben M., highway maintenance man III, 21 years; Shedd, Pansy Phyllis, intermediate typist–clerk, 4 years; Hinojos, Julio, highway maintenance man II, 12 years; Harrigan, Lawrence J., laborer, 11 years; White, Alexander, delineator, 30 years.

DISTRICT V

Hysell, Clarence A., highway maintenance man II, 34 years.

DISTRICT VI

Low, Lawrence J., highway foreman, 40 years; Allen, Edward N., highway maintenance man II, 30 years.

DISTRICT VII

Tassaro, Louise A., intermediate stenographer, 7 years; Smith, Elmer L., assistant highway engineer, 30 years; Whiteley, George E., delineator, 10 years.

DISTRICT X

Grove, Henry P., highway maintenance man II, 38 years; Lee, Harry W., highway landscape maintenance man, 16 years; Stice, Rollin K., senior highway traffic signal technician, 41 years; Stebbens, William G., drawbridge operator, 31 years; Tullis, Albert M., highway field office assistant, 35 years.

DISTRICT XI

McAdam, James W., highway maintenance man II, 11 years; Youde, Austra I., intermediate stenographer, 14 years.

HEADQUARTERS OFFICE

Baumgart, Walter M., records management analyst II, 33 years; Zick, Nell P., senior file clerk, 18 years.

MATERIALS & RESEARCH

Clinton, Ross H., associate steel inspector, 19 years; Glen, William W., highway field office assistant, 13 years.

Harlan F. Perdew

larlan F. Perdew, 57, design engi- for District V, died on February n San Luis Obispo.

native of Ottumwa, Iowa, he at- led grade and high school there at Mount Pleasant and later stud- at Iowa Wesleyan College.

erdew's first engineering job was n the Northern Pacific Railroad in consin in 1925. He joined the Di- on of Highways in 1930 as an er engineering aid in District IV n survey of the Pacheco Pass Road of Gilroy. In 1934 he served on struction of the San Francisco- land Bay Bridge and then returned District IV to the newly organized and cooperative projects depart- t.

n June of 1941 he first came to rict V as assistant traffic engineer. 1944 he returned to District IV's ic department, and subsequently it three years with the U.S. Army Europe as a traffic engineer on a lian basis.

eturning from Europe in April of 7, he spent the next three years n the traffic department in District working on a Bay area traffic ey. In 1950 he was transferred to dquarters Office in Sacramento, ing in the city and cooperative ects department as a senior high- engineer. In 1953 he returned to rict V as district design engineer, remained in that position until the of his death.

le was a member of the Institute Traffic Engineers. He was also a nber of the Kiwanis, Executives , San Luis Yacht Club and the mmonwealth Club of California.

addition to his wife, Adeline, Per- is survived by five children and grandchildren.

EXPRESSWAY TO FREEWAY

he State Department of Public rks has awarded a $1,056,815.63 tract for constructing an inter- nge at Steele Lane and frontage ds to convert US 101 between one- h mile south of Edwards Avenue Russell Avenue in Santa Rosa n expressway to freeway standards.

JOSEPH P. SINCLAIR DIES AFTER BRIEF ILLNESS

Joseph P. Sinclair, District Engineer of District IV, died in Redwood City on May 24 after a brief illness.

Sinclair, who was born on January 23, 1910, in Minneapolis, first joined the California Division of Highways in 1932 as rodman of a surveying party. With the exception of a few months during 1933 when he was employed by the Metropolitan Water District of Southern California and

JOSEPH P. SINCLAIR

his military duty with the Navy during World War II, Sinclair filled positions of ever-increasing responsibility with the Division of Highways.

A 1932 graduate of the University of Southern California, Sinclair held a bachelor of science degree in civil engineering. He was a member of Chi Epsilon, honorary civil engineering fraternity.

In 1933 he was assigned as a draftsman with District XI (San Diego). He remained with District XI until 1943 and served in several departments. Then he joined the U.S. Navy Seabees. At the time of his separation in late 1945, Sinclair was a lieutenant commander and the executive officer of the 126th U.S. Navy Construction Battalion.

Upon his return to civilian life, he resumed duties at District XI. In 1952 he was appointed assistant district engineer—design, for District VII (Los Angeles) and two years later was promoted to Principal Highway Engineer in District IV (San Francisco), first in charge of operations and later planning. In May 1959, upon the retirement of the late B. W. Booker, Sinclair was placed in charge of District IV as an assistant state highway engineer.

In this capacity, he bore the primary responsibility for all aspects of state highway planning, design, construction and maintenance in nine counties of the San Francisco Bay area. In recognition of the increased complexity and magnitude of the highway program in District IV, in April 1964 he was promoted to the civil service classification of metropolitan district engineer.

Sinclair was a fellow member of the American Society of Civil Engineers. He was a member of the Commonwealth Club of San Francisco, and at the time of his death was serving as director of the state employees division of the United Bay Area Crusade.

He is survived by his wife, Elizabeth, and a son, Michael. Mrs. Sinclair lives in San Carlos.

Two newspaper editorials appearing shortly after his death paid tribute to Sinclair's public services.

The San Francisco *Examiner* said:

"Mr. Sinclair had the difficult and often thankless task of directing the Bay area's freeway construction program. To that task he brought professional skill, integrity, and a high sense of dedication. An even-tempered and kindly man, he bore patiently the unjustified abuse too often heaped upon him by the thoughtless. We mourn the passing of a good friend and a good man."

The Redwood City *Tribune*, on the same day, commented:

"He proved himself as an able administrator and a competent engineer. He knew this area's highway problems and what should be done to alleviate them. His loss will be felt heavily in highway construction."

Paul Cowgill Retires; Has 31 Years Service

Paul Cowgill, district accounting officer in District IV, retired May 1, 1964, following more than 31 years of state service, all with the California Division of Highways.

Born in St. Louis, Missouri, Cowgill lived for a short time in Chicago, where he graduated from Austin High School. He completed his formal education at Georgetown University in Washington, D.C., where he studied for the foreign service, receiving a B.S. degree in 1924.

Prior to coming west, Cowgill was employed as an internal revenue agent in Washington, D.C., and New Orleans, and later as a cost accountant and auditor in Florida. For several years after his arrival in California in 1927 he worked for several private firms as an accountant and later as a tax collector with the County of Alameda.

PAUL COWGILL

Cowgill's first employment with the State of California was with District IV of the Division of Highways in its San Jose Maintenance Office. He served in that office as a timekeeper-clerk from 1933 until 1935, when he transferred to the Napa Maintenance Office. In 1937 he was promoted to supervising account clerk and transferred to Headquarters Shop in Sacramento. In 1943 he became chief clerk in the Bridge Department at Headquarters Office.

He returned to the San Francisco Bay area in 1946 as chief clerk of the District IV office.

Cowgill is an active member of the California State Employees' Association and has served that organization as regional director, director of law and legislation, secretary-treasurer and state president in 1944. Cowgill's primary interests have been in the retirement field and many benefits being enjoyed or which have been introduced for state employees are the results of his labors.

He is a member and past master of California Lodge No. 1, Free and Accepted Masons. Other affiliations include the National Conference of Public Employee Retirement Systems and the Quarter Century Club of the State of California.

Cowgill and his wife, Ida, a hearing reporter with the Department of Industrial Relations, live in Millbrae.

District Engineer Title Now Standard

Whether he heads the State's largest highway district, including Los Angeles County, or its smallest, with headquarters in Bishop, his official title is *district engineer*.

State Highway Engineer J. C. Womack moved to end some confusion which has arisen in recent months over a variety of designations by which the men who are in charge of the State's 11 highway districts are known.

For some time, Womack explained, there have been titles other than district engineer applied to the heads of the larger districts, depending on the size of the district's program and responsibilities.

To complicate the situation further, the two metropolitan districts, with headquarters in San Francisco and Los Angeles, have chief assistants to the district head who have been themselves officially known as "district engineers." This is because their civil service classification—principal highway engineer—is the same as the men in charge of seven other highway districts, who have always been referred to by the working title of district engineer.

From now on, Womack ordered, there will be only one district engineer in each district—regardless of civil service classification of the district's head. In the Los Angeles and San Francisco Districts, the former "district engineers" serving under the chief of those districts will now sign their official correspondence as "deputy district engineer," a new designation.

"The hodgepodge of titles was confusing to the public and called for clarification," Womack said. "We hope this change will simplify matters."

There are no changes in level of authority or responsibility involved, he pointed out—only the working titles in the case of four of the districts.

Here is the roster of district engineers and their deputies, under the redesignation of working titles:

District I (Eureka)	Sam Helwer
District II (Redding)	H. S. Miles
District III (Marysville)	Alan S. Hart
District IV (San Francisco)	J. P. Sinclair
Deputy District Engineers—Haig Ayanian, C. F. Greene, R. A. Hayler	
District V (San Luis Obispo)	R. J. Datel
District VI (Fresno)	W. L. Welch
District VII (Los Angeles)	E. T. Telford
Deputy District Engineers—A. L. Himelhoch, A. C. Birnie, A. W. Hoy, R. E. Deffebach	
District VIII (San Bernardino)	C. V. Kane
District IX (Bishop)	C. A. Shervington
District X (Stockton)	J. G. Meyer
District XI (San Diego)	J. Dekema

IN MEMORIAM

District III
Harold Shilder, Engineering Aid II

District V
Harlan F. Perdew, Senior Highway Engineer

District VII
Regina M. Begg, Intermediate Stenographer

District X
Earl M. Bailey, Ferry Operator I

Director's Office
Frances O. Mitchell, Senior File Clerk

INTERSTATE 5 PROJECT

The State Department of Public Works has awarded a $7,135,780.90 contract for constructing 16 miles of Interstate 5 freeway in the Corning-Bed Bluff area (Tehama County) between Corning Road and Kimball Road (four lanes from Corning Road to the future interchange with Route 99 at Rawson Avenue, and six lanes from there north to Kimball Road), about a mile west of the existing US 99W.

The Highway Motto

Or, First-year Latin Revisited

rom time to time the question of
to translate the Latin motto on
Division of Highways seal seems
ined to pop up for consideration.
current staff of editors, unwilling
ndure the stigma of less intellec-
pretensions than any previous
, feel that we must face the issue
on and take a crack at it, too.
r latest previous attempt see page
f the January–February 1956 issue
California Highways and Public
rks.)

n fact, we would like to go a bit
her. We would like to make our
eup what is known among schol-
as definitive—or, in plain language,
rap the matter up in gold foil and
t with pink ribbon.

Now, as any reader can see from
accompanying cut, the inscription
ls *Robur Directum Scientia Est*
Fortunae, or, if you would prefer
nore authentic-looking version,
OBVR DIRECTVM SCIENTIA
T VIA FORTVNAE." (Romans
n't seem the least bit concerned
ut distinguishing a "U" from a
")

f luck were with us, this motto, as
ny mottos are, would have been
ed from Virgil or Horace or some
er classical author and our worries
uld be over. All we would have to
would be to consult translations of
se works by an eminent Latin
olar or two to find out what it
ans. However, a check of Latin
cordances and dictionaries in the
te Library failed to turn up any
h classical phrase.

This leaves us with the likely as-
mption that it is a product of the
nd of the man who designed the
, Edward M. Muse, a former artist
delineator with the division who
d some 20 years ago. Incidentally,
. Muse also designed the seals for
Department of Public Works, the
partment of Motor Vehicles, the
ifornia Highway Patrol, the Divi-
n of Forestry, the California Toll
Bridge Authority, the California State
Water Authority and the California
State Employees' Association.

What we are probably trying to do,
then, is to translate a Latin phrase
back into English which is itself an
earlier translation from the original
English into Latin. Let's go ahead,
anyway, and see what we come up
with.

The first two words don't seem to
afford much difficulty. *Robur* means
"strength" and *directum* means "di-
rected" or "guided." With *scientia*,

however, ambiguity rears its ugly
head. (Or is it heads? Or horns? Or
are we thinking of a dilemma?) Any-
way, to continue, the classic meaning
of *scientia* is "knowledge," or in this
instance "by knowledge," being that
it's in the ablative (Wow!) case. But
with the rise of scientific research and
method during the 16th and 17th cen-
turies *scientia* acquired a second mean-
ing, in scholastic Latin, of "science."
In fact, as you can see from the close-
ness in spelling, it is the basis for our
own English word.

This offers us two translation possi-
bilities, then: "by knowledge" or "by
science."

The next two words don't afford
much of a problem. *Est* is "is" and
via is "road" or "way," or here rather
"the road" or "the way." (Romans
didn't clutter up their language with
articles.)

Now comes *fortunae*, the genitive
(or perhaps dative?) form of *fortuna*,
which raises another translation prob-
lem.

Basically, *fortuna* was a sort of neu-
tral word meaning "chance" or "fate"
or "lot." Thus, an ancient Latin
speaker could experience either *for-
tuna secunda* (good fortune) or *for-
tuna adversa* (bad fortune). Here we
have only "fortune," standing stark
and unbiased, waiting to go either
way.

We think, however, that it is rea-
sonable to assume that the seal de-
signer, Edward Muse, meant to wish
the division well. We can also cite an
example from a classic Latin author
where the unmodified word *fortuna*
is used in a favorable sense, namely in
the works of Cicero, and if this cur-
rent group of editors has one basic
tenet it is this: When it comes to
Latin prose, what's good enough for
Cicero is good enough for us!

The use of *fortuna* (fortune) in
Latin seems to have a lot in common
with our use of the word "luck."

There are times when we speak of
"good luck" and "bad luck," using
"luck" as a neutral word which must
be modified with an adjective to show
what kind we mean. Then we turn
right around and wish somebody "lots
of luck," obviously meaning to wish
him well.

The word "fortune" in English has
gone pretty much the same way. We
might wish that someone would ex-
perience good fortune, but if it turned
out that he did we would refer to him
merely as "fortunate."

We conclude, then, by offering the
following translation of the motto:
"Strength Guided by Knowledge Is
the Way to Fortune." That is, if you
are a classicist at heart. If you're a
modernist you'll probably want to
change "knowledge" to "science."

—S.M.

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e Sign Route 16 as it looks today. The ent highway was realigned several hundred to the north of the original route in 1949, inating the curves, and reducing the steep de by cutting through the hill in the back- und. Note that this hill is visible to the right in the older photographs.

ABOVE: This was the road that was. This view of the Plymouth Road, now State Sign Route 16, was taken two-tenths of a mile west of Sloughhouse, and 16 miles east of the city limits of the City of Sacramento. The view is westerly. If the view of the road and the auto proves to us that times have changed, it also casts doubt on the old saying that "what was good enough for Grandpa is good enough for us."

LYMOUTH ROAD; LOUGHHOUSE; IGN ROUTE 16.

ABOVE: Same view taken three years later. The roadbed was graded and a portland cement concrete slab 15 feet wide and 6 inches thick was installed. This pavement remained in use for 30 years. In 1949 when Highway 16 was realigned, this section was abandoned but not obliterated. Today a portion serves as an access road to the famous old landmark, Sloughhouse. BELOW: Easter Sunday, 1964, 45 years after the pavement was placed. The group in the background is enjoying an old fashioned Easter egg hunt.

These photos of the "Plymouth oad" via Sloughhouse in its various ges of development were sent in to e editor by W. F. Darden, 324 32d reet, Sacramento, Associate Con- uction Inspector, Sacramento Coun- Highway Department. Mr. Darden o included full captions for his pic- res, and we are indebted to him for owing us to give our readers this sight into the history of one small ece of road in our big system. We elcome old highway photos for our owing historical files, although we n publish only a few.

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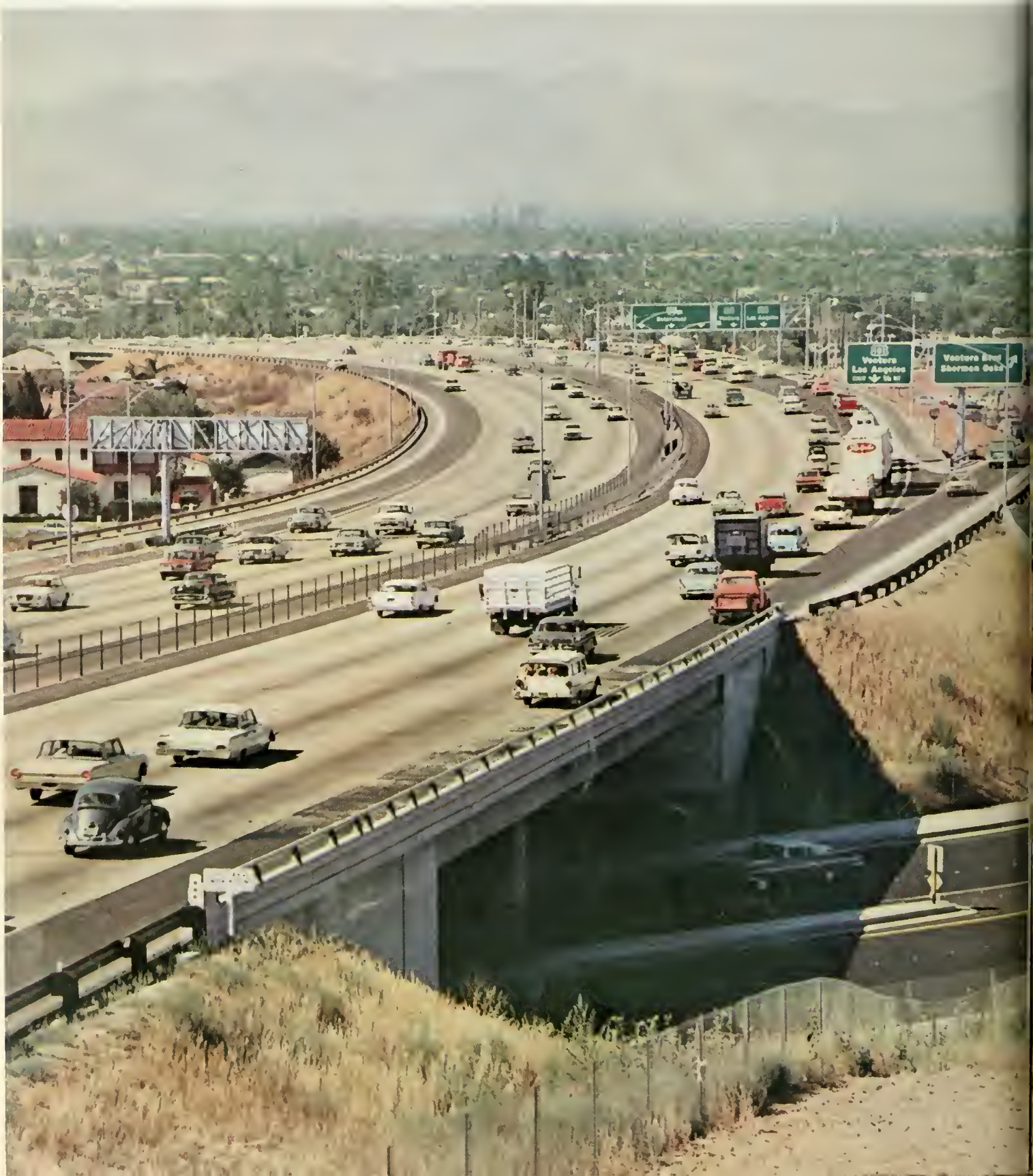

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TECHNOLOGY
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CALIFORNIA Highways and Public Works

CARMEL HILL

JULY–AUGUST
1964

President Inaugurates Transit Construction

President Lyndon Johnson listens to Governor Edmund G. Brown prior to setting off the blast marking the start of construction of the Bay Area rapid transit system. At far left is Adrien J. Falk, President of the Bay Area Rapid Transit District; at right, B. R. Stakes, the district's general manager. The ground breaking ceremonies were held at the Diablo Test Track, Concord, June 19.

"Transportation is a bipartisan problem. It is also national in scope. Seventy percent of our people live in urban areas, and 53 of our country's biggest metropolitan areas either border or cross state lines. Their transit problems ignore local boundaries; but their taxing powers are limited and their resources already strained.

"Congress has voted billions of dollars to build highways and airports, dredge harbors, build canals, and improve river navigation. In the last century it helped finance railroads and shipping lines to open up new areas of the country and new trade routes abroad.

"Now Congress and the Federal Government must help to solve the problem of transportation (caused by the ever increasing number of motor vehicles). These problems require us to create new concepts of cooperation —a creative federalism—between the Federal Government, State governments, and local communities."

These were the words of President Johnson at the dedication of the Bay Area Rapid Transit System in Concord, June 19.

The President predicted the passage of the Urban Mass Transportation Act which, at the time of his speech, had already passed the Senate and was soon to come to a vote in the House. He praised the "men of vision" who started 12 years ago to make the Bay Area Rapid Transit System a reality; a system the Act would assist.

Johnson warned that if America's urban areas do not develop adequate alternative means of transportation, "the coming crisis of congestion may do more to frustrate the growth and development of America than all the burning deserts and barren mountains which stood in the path of our ancestors a century ago."

alifornia Highways and Public Works

ial Journal of the Division of Highways, Department of Public Works, State of California

3 July-August Nos. 7-8

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are invited to use information contained herein and to request prints of any black and white photographs.

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ALIFORNIA HIGHWAYS AND PUBLIC WORKS
P.O. Box 1499
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FRONT COVER. State Sign Route 1, looking southwestward from the Carmel-Pacific Grove Highway and 17-Mile Drive interchange. The landscaping includes such native plants as Monterey Pine, Monterey Cypress, Gowen Cypress, California Live Oak and Carmel Creeper. Photo by John Meyerpeter.

BACK COVER. The San Diego Freeway (Interstate 5) near the four-level junction at the southern edge of San Diego's 1,400-acre Balboa Park. (See "Crosstown Freeway" page 2.) Photo by John Meyerpeter.

Crosstown Freeway

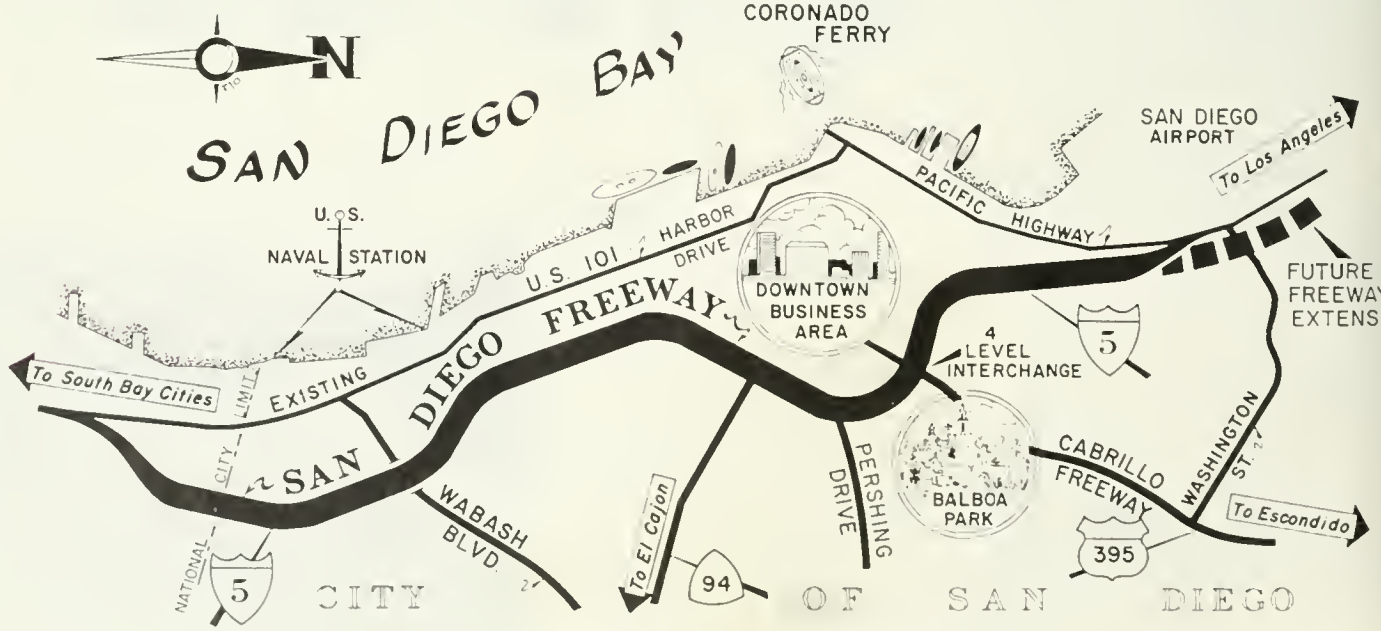
Interstate 5 Construction Progresses in San Diego

By JACOB DEKEMA, District Engineer

Dedication ceremonies on March 11, 1964 upon completion of almost 7 miles of the San Diego Freeway, marked the opening of a major segment of Interstate 5 between Palm Street near Lindbergh Field in San Diego and the Montgomery Freeway near the south city limits of National City. Five successive construction contracts totalling in excess of $30,000,000 were completed between 1960 and 1964 to add this long-needed link to San Diego's rapidly emerging freeway system.

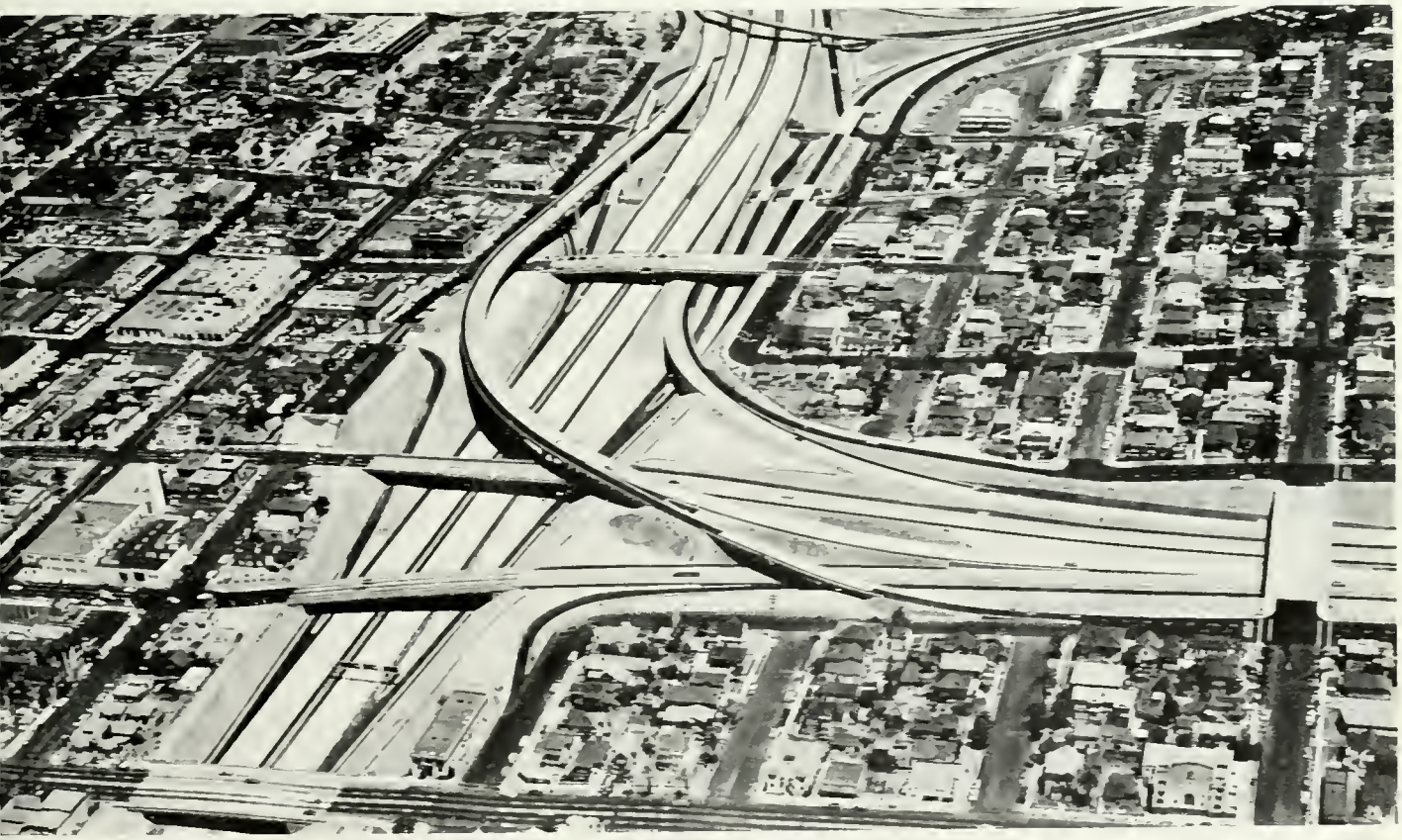
The importance of Interstate 5 to San Diego's economic and other development can hardly be overemphasized. Not only does it carry the principal traffic load between San Diego and Los Angeles, but its unique geographical location also makes it the terminus for many existing or antici-

View of the geometric pattern formed by interconnecting ramps of the Interstate 5-U.S. 395 four-level interchange, looking westward.



Map showing the location of the Interstate 5 Freeway through the City of San Diego.

The four-level Interstate 5-U.S. 395 interchange looking north, showing landscaping along the freeway in the vicinity of the structure.



oking north along the Interstate 5 Freeway where it borders the east edge of San Diego's business district. Sign Route 94 connects from right foreground. Pershing Drive connection (future Route 171 Freeway) is in upper right.

An aeriol looking northeast from above San Diega's business district showing the Interstate 5-U.S. 395 interchange and Balboa Park beyond.

ed freeways in San Diego County, st of which are in the San Diego tropolitan area.

Shift of Traffic

Since the recent opening of the San ego Freeway, there has been a cided shift of traffic from other hway facilities to the new freeway. ansfers of traffic from city streets demonstrated by current counts ich show a drop from 48,000 cars day to 21,000 a day on Harbor ive (old US 101) westerly of the freeway, while Main Street sterly of the new freeway) pped from 18,400 to 10,900 cars a . At the same time, traffic loads in- ased on city streets connecting to freeway's on- and off-ramps.

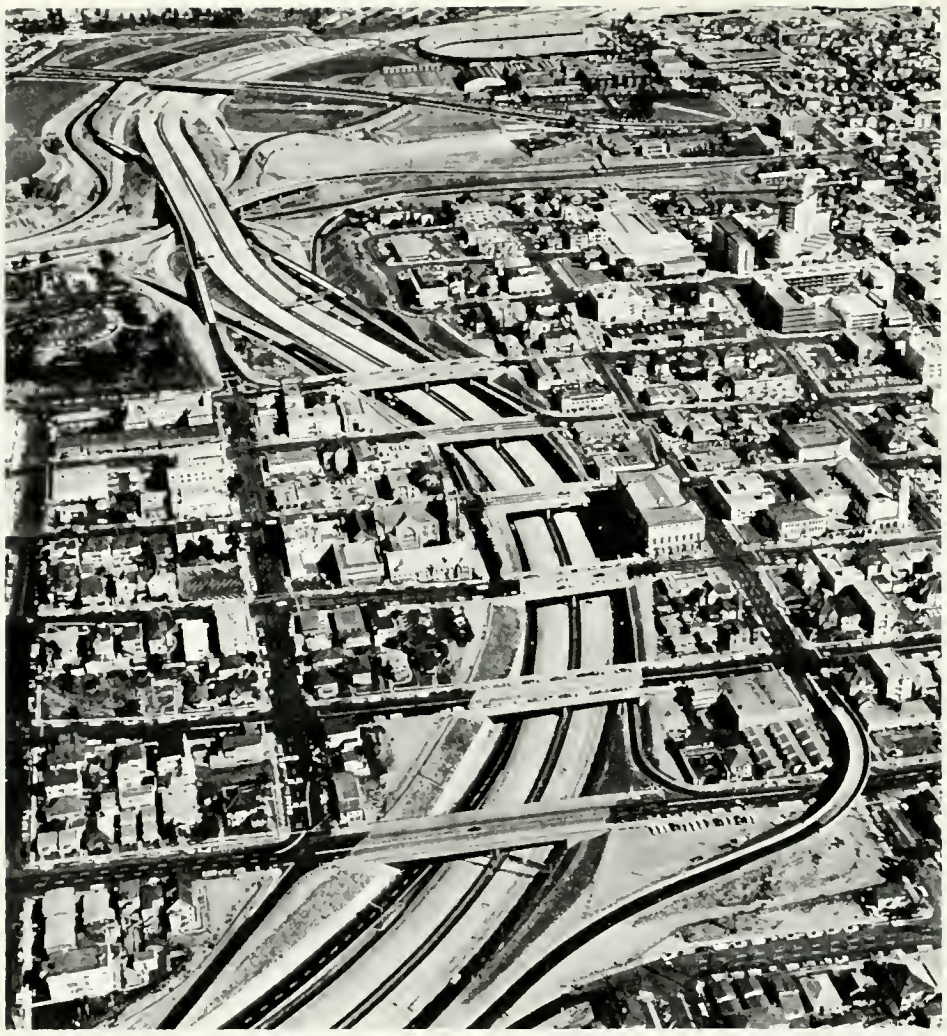
The relative advantages of a free- y, in contrast to a conventional hway facility, both in respect to ident as well as fatality rates have come an accepted fact. However, relationship of time to life is a little more obscure. Benjamin Franklin said, "If you love life do not waste time . . . for that is what life is made of." The 11 minutes saved by each vehicle between Washington Street in San Diego and the Montgomery Freeway in National City is equal to an average human life span every 49 days. Perhaps it might more impress the average two-way commuter to know that by taking advantage of the new freeway, he now has an additional 22 minutes a day that he may devote to a more productive use of personal time.

First Unit

The first unit to be completed was the four-level interchange area where Interstate 5 and US 395 joint, at the north edge of the downtown business section. The interchange, of necessity, required the use of a portion of Balboa Park's southern edge. This was a cause of concern to engineers and laymen alike, but with landscaping now well established, the project complements and rivals Cabrillo Freeway (US 395) through Balboa Park which had long been regarded by many as the most beautiful freeway in California. In addition, careful planning and close cooperation between municipal and state officials resulted in filling a number of previously unusable precipitous canyons, producing usable park areas exceeding the acreage occupied by the highway project.

Four successive contracts starting from the four-level interchange projected Interstate 5 northerly to Palm Street in the vicinity of San Diego's airport and southerly to a junction with the future State Route 171 Freeway at Pershing Drive, State Route 94, Wabash Boulevard (State Route 54), and the Montgomery Freeway which serves the South Bay area. A contract to widen the existing four-lane freeway to eight lanes an additional mile southerly, and to provide

The old Pacific Highway, looking south, at Ash Street. The new freeway eliminates 16 traffic signals and 30 railroad siding crossings.



The Interstate 5 Freeway looking east from the north edge of San Diego's business district. Canyon reclaimed by highway embankment is discernible in left background.

ramp connections at 24th Street in National City is presently under way.

A four-lane viaduct connection between Palm Street and the existing highway at Washington Street is presently under construction and will expedite the movement of through-traffic onto the newly completed freeway. This feeder will continue to serve the Point Loma and Midway-Frontier areas of San Diego after the new freeway is constructed northerly on new alignment to the vicinity of the San Diego River next year.

The current budget also includes three projects between Balboa Avenue in San Diego and the City of Carlsbad.

One of these, on which bids will be opened in September, extends Interstate 5 Freeway four miles northerly of Balboa Avenue to the south edge of Camp Matthews. Another, advertised in August, provides an additional 3½ miles of freeway from Miramar Road at the north edge of Camp Matthews to one-half mile south of Carmel Valley Road in Sorrento Valley. The third project, which will be advertised soon, extends the freeway northerly from San Marcos Road near Encinitas 5½ miles to the vicinity of Carlsbad. Currently under way is the construction of 5 miles of freeway from San Marcos Road south to Via de la Valle near Del Mar. This project should be completed in the summer of 1965.

Four contracts have been completed which provided fill and some bridges in unstable lagoon areas where long periods of settlement were necessary.

Simultaneous Completion

Because no adequate road connection exists between the existing US 101 in this section and the new freeway, it is impractical to route through traffic over sections of freeway as they are completed. The scheduling of construction units between San Diego and Carlsbad was therefore based on nearly simultaneous completion of the various segments. The controlling factor has been the evacuation of Camp Matthews by the US Marine Corps to permit freeway construction in that area. Present indications are that a contract through Camp Matthews can be awarded late in 1964 or early 1956 with completion in 1966.

Two other projects still to be budgeted and the three projects in the current budget should also be finished in 1966 to permit opening to traffic the entire section between Balboa Avenue and the existing freeway in Carlsbad.

By this time work should also be underway through Camp Pendleton between Oceanside and San Clemente, and along Mission Bay between the San Diego River and Balboa Avenue. We anticipate that by the end of 1968, Interstate 5 will be carrying uninterrupted freeway traffic from the North San Diego County line to the United States border at San Ysidro.

Traffic studies indicate that additional lanes will have to be added to the existing freeway both north and south of San Diego. Plans to widen the four-lane sections through Oceanside and Carlsbad, as well as southerly from National City to the International Boundary, are presently being prepared.

CONSTRUCTION COSTS

The California Highway Construction Cost Index for the second quarter of 1964 rose to 248.7 (1940 = 100) which is 2.6 points or 1.1 percent over the first quarter of 1964.

The index has changed very little during the fiscal year ending on June 30 and indicates a continuation of the trend of stability in highway construction cost.

The number of bidders per project during the second quarter averages 5.4 which is 0.4 under the previous quarter.

More Bridge Awards

Two of the ten nationwide awards offered by the Prestressed Concrete Institute in its 1964 Annual Awards Program were taken by California. Awards of Merit were won by the Willow Creek Bridge on the Monterey Coast Highway 65 miles south of Monterey, and by the three prestressed carrying beams over the Arroyo Seco flood control channel in Los Angeles.

This competition is sponsored each year by the Prestressed Concrete Institute to recognize the most outstanding prestressed structures completed during the previous year.

Falsework Eliminoted

California makes considerable use of prestressing in concrete to achieve construction without falsework, to design beams which can be erected over busy highways without an extended disruption of traffic, and to achieve a thinner, more attractive profile for some of the structures.

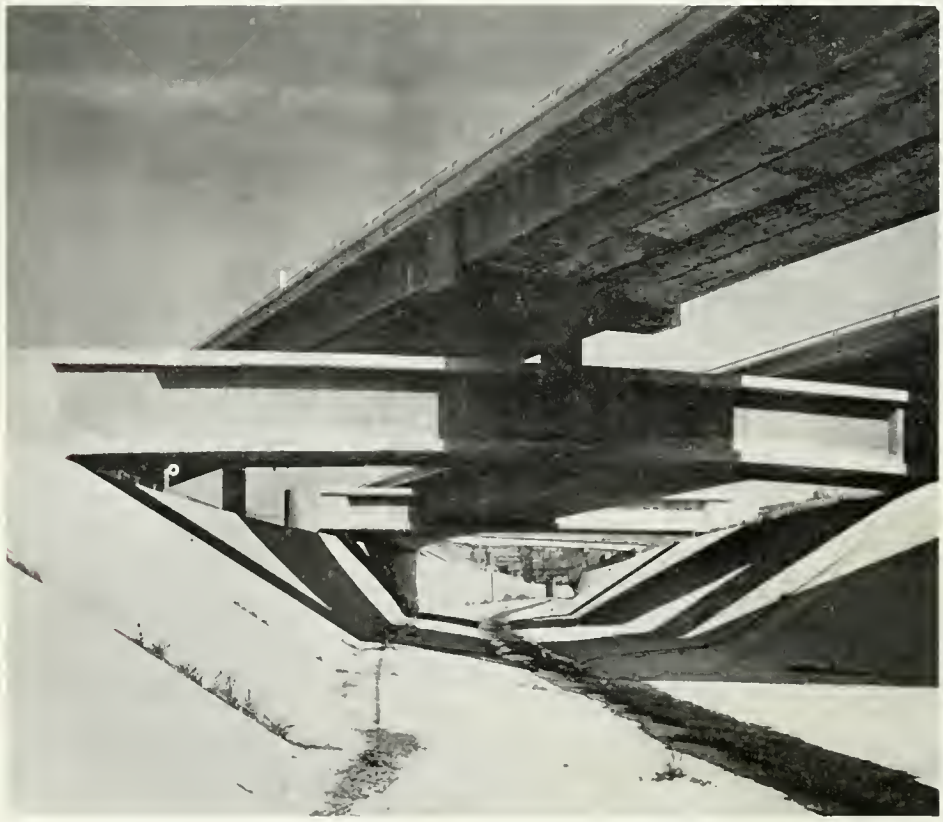
The Willow Creek structure realized a maximum benefit from prestressed concrete. In a remote location, the beams were trucked to the site to create a thin, light-appearing structure in a most attractive setting beside the ocean. The prestressed beams were 80 feet long and the six-span structure rested on single columns about 110 feet above the stream bed. The bridge carries the coast highway across this deep canyon in the rugged coastline forming a pleasing contrast to this massive country and in this setting becomes a true thing of beauty.

Three Carrying Beams

The three carrying beams over the Arroyo Seco flood control channel do not have the naturally attractive setting of Willow Creek, but in their own way they contribute a great deal to the soaring grace of an involved

One of the three prestressed carrying beams over the Arroyo Seco flood control channel in Los Angeles. The beam supports structures on the Elysion viaduct.

The Willow Creek Bridge on Sign Route 1 some 65 miles south of Monterey. The prestressed beams create a thin, light-appearing structure in an attractive setting beside the ocean.



The other two prestressed carrying beams (see preceding page) across the Arroyo Seco flood channel. The beams contribute to the soaring grace of an involved system of freeway ramps.

system of freeway ramps under congested circumstances. Prohibited from putting any columns in the flood control channel, it was necessary to provide supplementary supports for the concrete and steel spans crisscrossing the channel. The designers solved the problem with prestressed carrying beams. These are hollow box girders with spans of as much as 130 feet and stressing forces as high as 9,100,000 pounds. This is probably the highest concentration of prestressing force ever contained in a single beam up to the present time.

Unique Solution Recognized

The judges recognized the unique solution which enabled the designers to simplify and improve the overall appearance of this complicated interchange.

California was the recipient earlier this year of awards by the American Institute of Steel Construction for aesthetic design of four more of its structures on the State Highway System. (See January-February, 1964, issue.)

New S. F. Freeway

Four Miles of Route 82 Built on New Alignment

By HAIG AYANIAN, Deputy District Engineer

Early this fall motorists will be able to drive from the southwesterly section of San Francisco to the Bay Bridge and across to the East Bay and beyond *without once using a city street*. This safer, signal-free driving will be possible as soon as two contracts currently under construction on Route 82, known locally as the "Southern" Freeway, are finished.

The route, built on completely new alignment, is located in the natural traffic corridor serving former US 101, which has followed Alemany Boulevard and San Jose Avenue. It also occupies the old Southern Pacific Railroad right-of-way for almost two-thirds of its length. This was the old "Main Line," built in the 1860's as a rail link between San Francisco and San Jose. Passenger trains stopped using these tracks in 1907 when the bulk of Peninsula train traffic was shifted to the western shores of San Francisco Bay.

More than six years and four major construction projects were required to complete approximately four miles of six- (ultimate eight-) lane freeway from Orizaba Avenue to the Route 82/101 Interchange. The entire job

aking westerly toward San Francisco City College from the vicinity of Theresa Street pedestrian overcrossing. Also visible are Baden Street and Paulding Street overcrossings. The split level median was utilized to reduce right-of-way requirements and avoid excessive retaining wall height.

was planned as one unit and broken down into four projects for ease of construction. Total cost of construction was $24,000,000 which was almost matched by the $18,000,000 cost of right-of-way acquisition. The City and County of San Francisco contributed $1,800,000 toward the cost of construction and $500,000 toward right-of-way purchases. Route 82 is one of the few major state highways in San Francisco that is not being constructed with Interstate funds.

In City Master Plan

This freeway route was originally conceived by the City of San Francisco and appears on the city's master plan in substantially the same location it now occupies. On June 21, 1956, the California Highway Commission adopted the section between Orizaba Avenue and Route 101 as a freeway route. The freeway agreement with the City and County of San Francisco was executed on August 29, 1956, and revised on July 7, 1958.

A natural trafficway exists in a valley in the southern part of San Francisco running in a southwesterly direction to the San Mateo County line. Historically, all traffic from the residential areas of the western parts of the city and northwestern San Mateo County destined for the downtown and industrial areas of San Francisco has been forced by the topography of the valley to use this natural corridor, through which Alemany Boulevard and San Jose Avenue pass.

When the need for the "Southern" Freeway was being evaluated, it was found that the combined average daily traffic on these routes exceeded 53,000 vehicles. In addition, afternoon peak-hour traffic on the James Lick Freeway (US 101) bound for Alemany Boulevard backed up in such a manner as to block two of the four southbound lanes, resulting in a slowing down, and in many cases a complete stoppage, of traffic in this area.

When the new freeway is opened to traffic, it is expected to carry 50,000 vehicles per day and reduce the traffic load on Alemany Boulevard and San Jose Avenue to 24,000. The new freeway is expected to carry an average daily traffic load of 120,000 to 200,000 by 1985.

MAP BELOW AND OPPOSITE PAGE. The new Route 82 Freeway in San Francisco extends from the Route 101 interchange to Orizaba Avenue.

Construction Problem

The problem of keeping more than 000 cars moving through the con- uction zones each day was the con- lling factor on all four contracts. was solved by a carefully engi- ered schedule of stage construction provide for the diversion of traffic planned detours as each job pro- ssed. Although the detours were y temporary, they were built to ictural standards comparable to streets. In general, the contractor s required to provide full width traveled way between approxi- tely 4 p.m. and 9 a.m. the follow- workday morning. At all other es, multilane roadways were re- ed by one lane in each direction— only when and where construc- n required.

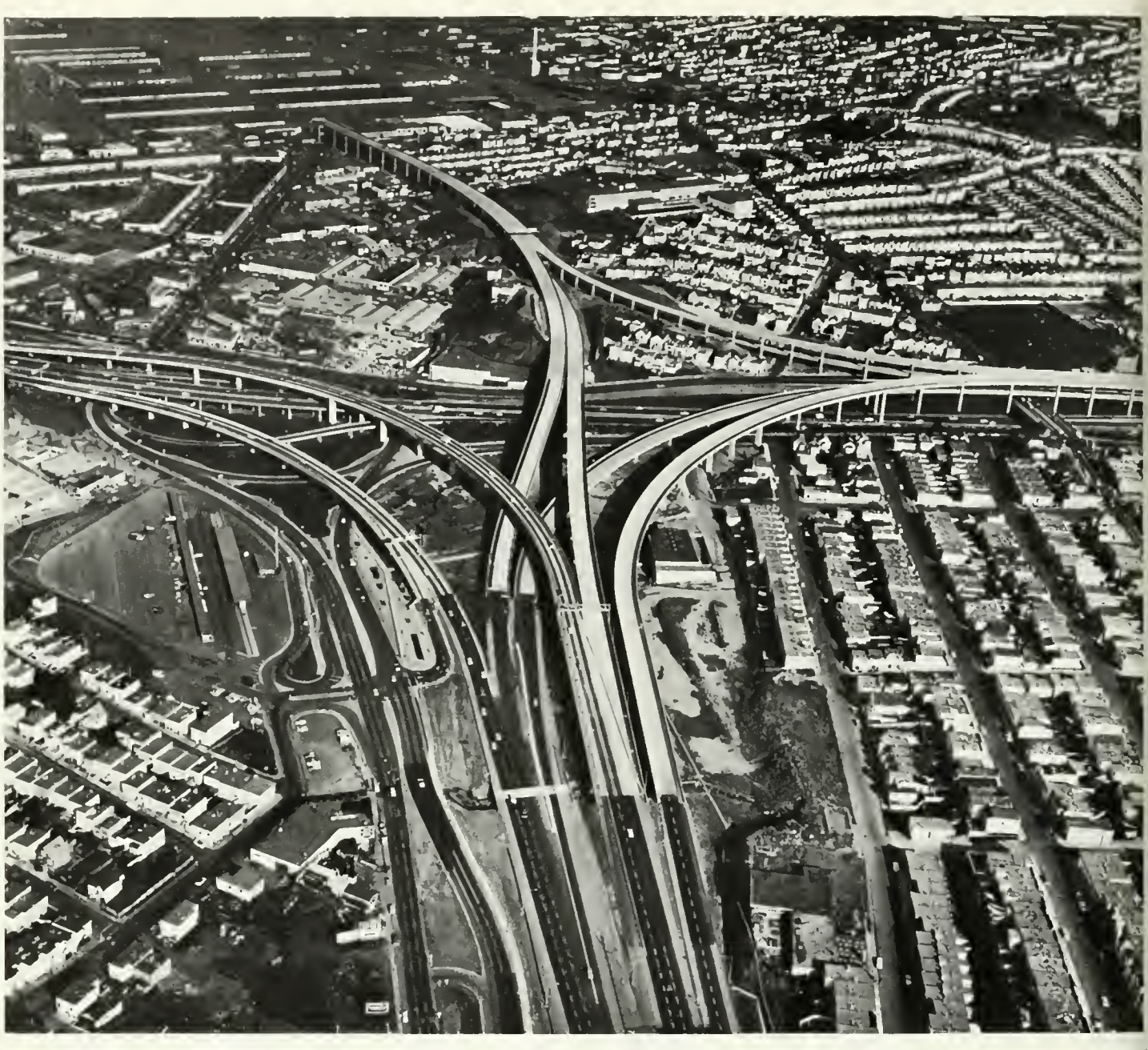
Route 82/101 Interchange

The first step on the construction of the "Southern" Freeway was taken on July 15, 1958, when the Guy F. Atkinson Company began work on a directional interchange between Routes 82 and 101. The work included installation of a prestressed concrete slab bridge at the Bacon Street Undercrossing, widening of the Cortland Avenue Undercrossing, pedestrian undercrossings at Burrows Street and Thornton Avenue, 1,600 lineal feet of retaining walls, and rough grading and excavation only for 0.6 mile of Alemany Boulevard to Trumbull Street.

This project was some 110,000 cubic yards deficient in embankment material. The bulk of the borrow was imported from the Civic Center Plaza, where a large excavation was being made for Brooks Hall and the parking garage, both underground.

One unusual construction feature on this job was the installation of 10 precast and prestressed girders over the James Lick Freeway in six hours. Traffic was detoured off the freeway from midnight to 6 a.m., while two 35-ton truck cranes were used to set the girders in place. During this job the existing Alemany structure was braced with timber bents under the operating area of each crane.

Under a cooperative agreement, the City and County of San Francisco contributed $1,585,000 for construction, right-of-way acquisition, and utility relocation for its share of all work done on this unit south of Silver Avenue. A portion of these funds was spent for the relocation and enlarge-



An aerial view of the Route 82/101 interchange which has been in service since June of 1960. East of James Lick Freeway is the recently completed extension of Route 82 which will some day connect with the Route 480 Freeway in the vicinity of the Bay Bridge.

ment of a 5-foot, 9-inch diameter sewer 500 feet long near Phelps Street and Bayshore Boulevard.

This unit opened to traffic on June 20, 1960. Resident engineers were Loren L. Krueger and G. M. Low for the Bridge Department and H. A. Hart representing the district.

Route 82/101 Interchange to Milton Street

Three months later, in September 1960, contractor Charles L. Harney, Inc. began work on the adjoining section of Route 82, a $4,273,000 project to build 1.1 miles of freeway between the Route 82/101 Interchange and Milton Street, one block west of the Mission Street Viaduct.

Structures included two bridges to carry Alemany Boulevard traffic over the freeway near Gaven and Congden Streets, overcrossing at Mission Street and Justin Drive, the St. Mary's and Gladstone Drive Pedestrian Overcrossings, and 10 concrete retaining walls built to heights of up to 36 feet to reduce right of way requirements.

When the city widened the old Mission Street Viaduct in 1951, an arch section was built over the Alemany Boulevard trafficway. To preserve the architectural integrity of this structure, it was decided to match the arch with the new Mission Street Overcrossing. The Bridge Department designed the structure as a box girder with a parabolic arch over the Route 82 freeway. The area between the freeway and Alemany Boulevard was walled in.

A combination sanitary and storm ver was enlarged and relocated out- e the freeway right of way under ooperative agreement with the City d County of San Francisco, which ntributed $200,900 for the construc- n of a double 6- by 10-foot re- orced concrete box culvert for 00 feet along relocated Alemany ulevard, crossing the freeway at umbull Street.

Since there was a deficiency of 000 cubic yards of embankment terial, borrow sites were specified state-owned property within the ht of way for the next construction it of Route 82. This requirement abled the contractor to obtain nec- ary embankment material for the ject under construction while re- ving material which would other- se have become surplus with the t unit. The slopes and grading nes specified for the borrow site re at or above the desired grade.

The eastbound lanes were built first d construction of the westbound es was not started until after east- nd traffic had been routed onto the v freeway lanes. The contractor cted to use the steel sideform thod of placing Portland cement ncrete pavement instead of the slip m method. This job was finished October 13, 1963. Resident engi- r was H. A. Hart and the Bridge partment was represented by David pkins and George Low.

Mission to Ocean

A little more than a year after the ve job began, the same contractor, rles L. Harney, Inc., started work the next unit of the Route 82 free- y, a $6,080,000 project to build 1.3 es of freeway, 13 structures, 9 re- ing walls, and a sewer protective between Mission Street and 0.4 e north of Ocean Avenue. This ject is the key job of the four cribed in this article, both from the dpoint of the number and type of ctures and from the fact that the lities of the San Francisco Bay a Rapid Transit District will enter freeway right-of-way within the ject limits.

Representatives of the Division of ghways, the City and County of Francisco, and the transit district have been working in close cooperation for some six months planning the proposed transit facilities. The transit rail lines as planned will be either on or parallel to the "Southern" Freeway right-of-way all the way from the Baden Street Undercrossing to the San Francisco-San Mateo County line in the vicinity of the Knowles Avenue Transit Station site.

This cooperation was maintained by regular biweekly meetings among representatives of the three organizations and constant interchange of working drawings between the transit authority and highway engineers to coordinate design. Since work on the freeway started on December 13, 1961, and it was not until November 1962 that the electorate authorized the creation of the transit district, freeway construction had been under way for more than two years before design work even started on the transit facilities. However, it is the goal of the combined operation that by the time this article is published, the alignment of transit facilities along the Route 82 freeway will be firm enough to allow the transit engineers to proceed with final design.

Balboa Park

This section of the freeway runs through Balboa Park and across the southeasterly corner of the City College of San Francisco. When it is completed, it will siphon through traffic away from the highly congested city streets of neighborhood shopping districts along Mission Street.

Negotiations with the City and County of San Francisco over pur-

This view shows the Oceon Avenue overcrossing in the foreground with traffic routed around construction. In order can be seen the Genevo Avenue overcrossing and the San Jose Avenue detour.

This view looking east shows the detouring of traffic from the completed portion of the freeway east of the reconstructed Mission Street viaduct to existing Alemany Boulevard. In the background are the ramps and overcrossings provided for traffic on relocated Alemany Boulevard.

chase of rights-of-way in this area were lengthy and involved. But on June 26, 1963, the State of California agreed to pay $807,000 for the land and improvements on approximately eight acres of property in Balboa Park and on the campus of the City College of San Francisco.

Structures included overcrossings at Paulding Street, Baden Street, Monterey Boulevard On-ramp, Monterey Boulevard Eastbound, and Monterey Boulevard Westbound. Undercrossings were provided at San Jose Avenue (Route 82), San Jose Avenue (outer right), San Jose Avenue (outer left), Branch East, Lyell Street, and Bosworth Street. Other construction included pedestrian overcrossings at Theresa and Lamartine Streets, nine retaining walls for a total length of 7,850 feet, and a 20- by 80-foot protective slab over the reinforced concrete pipe sewer crossing the freeway at Santa Rosa Avenue.

There was an excess of excavation material on this job amounting to more than 400,000 cubic yards, which the contractor disposed of by filling in the Bay tidelands owned by himself. He also used this site for the disposal of 5,000 cubic yards of reinforced concrete rubble resulting from the demolition of the existing Bosworth Street Undercrossing.

Structure Construction

An engineering and construction problem of no mean proportions was encountered on this unit because of the placing of 11 out of the 13 bridges and 7 out of the 9 retaining walls in the space of less than a third of a mile between Theresa Street on the west and Lyell Street on the east. It was extremely difficult to preserve construction survey reference points in the working area because bridge construction and roadwork operations were often performed simultaneously in this limited area.

Two of the bridge structures, the San Jose Avenue Undercrossing (Route 82) and the Branch East Undercrossing, were built as box girder, single-span, rigid frame, cut-and-cover tunnels under re-routed San Jose Avenue and the freeway. Because most of the bridge construction was performed simultaneously with the road-

Looking northeost from the vicinity of the San Jose Avenue-Sickles Avenue undercrossing along the alignment of the Ocean to Orizaba Avenue project.

Looking westerly toward Monterey Boulevard and access ramp construction.

work, the contractor was required to leave openings in the bridge falsework to permit his heavy equipment and materials to pass through to other sections of the job.

The Branch East Undercrossing, which is 450 feet long, is built on a skew of 60 degrees and the Monterey Boulevard On-Ramp Overcrossing, which, at 710 feet, is the longest structure on this unit, is built on a 40-degree skew to provide for the required minimum radius of curvature, together with span lengths and accelleration lane requirements. To keep right-of-way requirements to a minimum, the median on the portion of this section of Route 82 was designed on a split level from Havelock to Lyell Street.

The demolition and reconstruction of the Bosworth Street Undercrossing was accomplished in two stages, half of the street being open at a time to provide traffic service to both Bosworth Street and San Jose Avenue. Protective sheds were placed over Bosworth Street during demolition work to protect passing traffic.

Because of the clearance requirements of four levels of traveled way, the abutment walls of the San Jose Avenue Undercrossing near Monterey Boulevard are 35 feet high. Another difficult stage of construction in the same vicinity was excavating for retaining walls up to four stories high adjacent to existing streets while permitting traffic to pass through.

On roadway construction, two 12-foot subgrade machines were tied together to permit trimming of the cement-treated base on a 24-foot width.

This section of the Route 82 freeway will not be usable until completion of the fourth unit, described below. The Resident Engineer is E. L. Raymond, while K. L. Baumeister represents the Bridge Department.

Ocean to Orizaba

The same contractor started work October 22, 1962, on the fourth unit, a 1.8-mile section from Havelock

treet, 0.4 mile north of Ocean Avenue, to Orizaba Avenue. Actually, Route 82 leaves the freeway alignment at San Jose Avenue on this project and follows San Jose Avenue in a southwesterly direction to the San Francisco-San Mateo County line. The remainder of this job, from San Jose to Orizaba Avenue, is on State Highway Route 1.

Since this and the preceding unit were both being built by the same contractor and were both scheduled to be finished at approximately the same time, pouring of the portland cement concrete pavement was done in one continuous operation. Subcontractor Gordon H. Ball used a modified slipform paving machine 36 feet wide to pave three 12-foot lanes on both jobs in a single pass, then the machine was turned around and the opposite lanes were paved in another pass. This technique had never before been used in this district for a 36-foot width.

Structures on the fourth unit included overcrossings at San Jose, Geneva and Ocean Avenues, and the San Jose Avenue Offramp at Sickles Avenue. Undercrossings were provided at the Sickles Avenue Onramp and the San Jose-Sickles Separation, and pedestrian overcrossings were installed at Havelock Street and Whipple Avenue.

In addition, a temporary onramp connection to the freeway was provided from Alemany Boulevard at Orizaba Avenue to allow full use of the freeway from Orizaba Avenue to the Route 82/101 Interchange and divert such traffic from city streets. One unusual feature was the provision of pedestrian access ramps to the freeway from the Ocean Avenue Overcrossing to permit passengers from express buses on the freeway to transfer to locals on Ocean and Geneva Avenue.

Other structures included nine reinforced concrete cantilever retaining walls on spread footings totalling 5,410 feet in length, two concrete crib retaining walls, and two gravity type retaining walls. One crib wall, which is 35 feet high and 450 feet long, was placed to protect the Cayuga Playground area from erosion. The abutment wing wall at the San Jose Avenue Overcrossing and the pedestrian access ramps at the Ocean Avenue Overcrossing were built in two stages to provide continuous traffic service.

Resident Engineer on this job was K. G. Nakagawa and L. S. Miyashiro represents the Bridge Department.

Freeway Extensions

The westerly extension of this freeway is now under construction as part of a major contract for construction on Interstate Route 280 in San Mateo County. When the work is completed, toward the end of 1966, this 0.4-mile section of Route 1 will carry "Southern" Freeway traffic from Orizaba Avenue to the county line in the vicinity of St. Charles Avenue and join to Interstate Route 280 in San Mateo County.

East of the James Lick Freeway (Route 101), work was completed February 10, 1964, by Peter Kiewit Sons' Company on a $4,100,000 project to build a two-level viaduct from the Route 82/101 Interchange to Newcomb Street on Route 82. This unit will not be usable until completion of the next unit, for which bids were opened on May 20, 1964. The contract has been awarded to the Guy F. Atkinson Company to build the easterly extension of Route 82 from Newcomb to Army Street, including ramp connections to Army Street and Pennsylvania Street. These ramps will be an integral part of the future Islais Creek Interchange. This Interchange will be built when future Route 87, often referred to locally as the "Hunters Point Freeway," is constructed in this area.

Completion of this $6,100,000 project, expected early in 1966, will provide an alternate route paralleling U.S. 101 from the Route 82/101 Interchange through an industrial area of San Francisco to the general vicinity of Army Street above Third Street.

Landscaping

It was planned to landscape each section of Route 82 after construction was completed. Landscaping of the Interchange was completed on March 15, 1962, at a cost of $46,000. The sum of $110,000 has been budgeted and bids were opened on June 3, 1964, to landscape the section between Route 101 and 0.1 mile east of Milton Street. The 1964-65 Construction Program contains $75,000 for landscaping the one-mile section between Havelock and Mission Streets; another $75,000 will be required to landscape the section of Route 82 freeway from east of Orizaba Avenue to 0.4 mile north of Ocean Avenue and $35,000 to landscape the easterly extension from Route 101 to Revere Avenue.

With the completion of the construction work described above, Route 82, the "Southern" Freeway, will provide six lanes of full freeway across some six miles of the southern part of San Francisco from the southwesterly area to the industrial areas east of US 101. Later, when traffic conditions warrant, another lane will be constructed for each direction of freeway traffic within the existing right-of-way to provide the ultimate eight-lane width planned.

Bids Called on Two Big Interstate Jobs

The State Division of Highways has called for bids on construction of two major sections of Interstate 5 in *San Diego* and *Glenn* Counties.

The $6,612,000 *San Diego County* project calls for grading and paving to construct 3.4 miles of eight-lane Interstate 5 freeway on new alignment between Miramar Road and one-half mile south of Carmel Valley road near the north city limits of San Diego. The project includes construction of an interchange structure linking Interstate 5 with the future Interstate 805.

The $6,600,000 *Glenn County* project calls for grading and paving to construct an initial four lanes of an ultimate six-lane Interstate 5 freeway on new alignment between one mile north of Artois and the Tehama county line, a distance of 11 miles. The project calls for an extension of State Sign Route 32 from Sixth Street in Orland to connect to the new Interstate 5 route west of Orland, including an interchange between the two routes at the latter point.

WASHO

Post-1972 Federal Aid Outlook Discussed at 43d Annual Session

The current accelerated Federal Aid program for highway improvement will undoubtedly continue in some form in the 1970's, according to the consensus of leading speakers at the 43d annual conference of the Western Association of State Highway Officials, held in San Diego June 15-18.

But there were some differences of opinion about what size and shape the future form of federal financing should assume.

The conference, attended by some 500 delegates, visitors and other guests, most of them from the 14 western states whose highway departments comprise the association, along with federal agency representatives, also provided the setting for discussion of a wide range of other topics in both general and technical sessions.

Prominent among these subjects were the matter of specifications, "spot correction" of hazardous locations, directional signing, truck weight limitations, and the current nationwide program of highway research. Committee sessions also covered new developments and problems in the fields of construction, maintenance, communications, forest roads, right-of-way and administration.

At its concluding session at the El Cortez Hotel on June 18, the association elected C. Taylor Burton, Utah Director of Highways, as its new president, succeeding Oregon State Highway Engineer Forrest Cooper. Other new officers are Colorado State Highway Engineer Charles E. Shumate, vice president; and California Deputy State Highway Engineer George Langsner, secretary-treasurer.

Executive Committee Listed

In addition to the three newly elected officers and Past President Cooper, the executive committee of WASHO for 1964-65 will include: Charles G. Prahl, Washington State Director of Highways; Richard G. Pfister, member of Wyoming State Highway Commission; T. B. White, New Mexico Chief Highway Engineer; and S. N. Halvorson, member of the Montana State Highway Commission.

The association adopted resolutions urging Congress to oppose a proposed reduction of $1,000,000 in the 1965 federal appropriation for national forest highways and restore the total to the original recommended figure of $33,000,000; and to increase the annual expenditure for forest highways to $85,000,000 beginning in 1966. The latter resolution pointed to the increased use of forest highways for both recreational travel and utilization of resources and their role as "integral links in principal highway systems"

... Continued on page 20

A view of the Cotillion Room at the El Cortez Hotel in San Diego at the opening general session of the 43rd Annual WASHO conference.

Hewes Award

Moskowitz' Research in Traffic Engineering Wins New Recognition

The value of numerous and trail-reaking research reports in the field f traffic engineering prepared by Karl Moskowitz has won him a new onor—the Dr. L. I. Hewes Award or outstanding contribution to high-ay development among employees f 14 western states.

Moskowitz, who is California's as-stant traffic engineer in charge of eometric service and traffic service, as adjudged the winner of the 1964 ward and was presented with a laque and a $500 check at the an-ual dinner of the Western Associa-on of State Highway Officials, held n San Diego June 17 as a part of the 3d annual WASHO Conference.

The award was established by *Western Construction* magazine in 951 to honor the memory of the te Dr. Hewes, former western re-ional chief of the U.S. Bureau of ublic Roads and one of WASHO's ounders. The publication provides ne plaque and cash award, but the nnual winner is selected by WASHO rom entries submitted by the various ighway departments.

Worked for BPR

Moskowitz began his career as an ngineer with the U.S. Bureau of ublic Roads soon after graduation rom the University of California at erkeley in 1930. During World War he was commissioned in the U.S. rmy Corps of Engineers, and built r field runways and roads in New Guinea and the Philippines.

He resigned from federal employ-ent in 1948 to join the California Division of Highways and has been ssigned to the Sacramento headquar-ers since that time.

Beginning as early as 1947, and in ncreasing volume since 1954, Mosko-itz has contributed a steady stream f research reports in highway en-ineering which have had consider-ble influence in the field of traffic peration and freeway design not only in California but throughout the nation and even abroad.

Karl Moskowitz (left) accepts the Dr. L. I. Hewes award from Editor Robert L. Byrne of Western Construction magazine. The presentation took place at the annual "family dinner" of the Western Association of State Highway Officials in San Diego on June 17.

Among his earlier contributions were the initiation of a sufficiency rating system for highways, and studies of lower-case lettering for directional signs. The latter study, based on California practice, resulted in the adoption of lower-case lettering on the New Jersey Turnpike and the New York State Thruway. This type of lettering is now standard for the National Interstate System.

Writes Prize Paper

One of the later studies, which Moskowitz coauthored with George M. Webb, was adjudged by the Highway Research Board as the best paper presented at its annual meeting in 1957. This was "California Freeway Capacity Study, 1956," an analysis of the operating characteristics of several high volume freeways. Appearing at the outset of the accelerated nationwide highway program, this report was in heavy demand on the part of highway planners in states which were just then getting into the design stage on major urban freeways.

In 1962 Moskowitz was coauthor (with Leonard Newman) of a paper entitled "Notes on Freeway Capac-

... Continued on page 21

WASHO Past President W. Otis Wright, Nevada State Highway Engineer (at left) officiates at the installation ceremony for the new officers. Left to right: C. E. Shumate, Colorado, vice president; T. B. White, New Mexico, executive committee; C. Taylor Burton, Utah, president; George Langsner, California, secretary-treasurer; Richard G. Pfister, Wyoming, executive committee; Charles G. Prahl, Washington, executive committee. Not present for picture: S. N. Halvorson, Montana, executive committee.

WASHO

Continued from page 18 . . .

where construction has been recently speeded up under other programs.

No resolutions were adopted concerning the federal aid outlook for the period after 1972, when the current accelerated financing program enacted in 1956 is scheduled to terminate. The American Association of State Highway Officials already has this matter under study, as was pointed out by a number of conferees, including AASHO President J. Burch McMorran, New York State Superintendent of Public Works.

McMorran noted that it was important to have AASHO's comprehensive nationwide review completed by 1967 as a basis for determination of highway needs in the post-1972 period and to give the states and the highway industry time to prepare for whatever future program Congress might adopt.

Coution Agoinst Overestimation

McMorran also cautioned against over-estimating the role of the completed Interstate System in the nation's total vehicular transportation picture. Even though the 41,000-mile interstate network is expected to carry 20 percent of the total traffic by 1972, he pointed out, the total traffic to be handled will increase by 25 percent in the same period, adding: "Unless we extensively upgrade our existing systems so they can more effectively complement the Interstate, we will inevitably suffer new traffic problems and we will fail in our effort to reverse the appalling highway injury and fatality records which cause us deep concern."

WASHO President Forrest Cooper, in his major address, also emphasized the importance of the "blood vessels and capillaries" of the future "circulation system of which the Interstate will provide wonderful 'arteries'." He urged a post-1972 program with "a reasonable amount of additional interstate to integrate the system" but with flexibility so that "state programs may be geared to state needs."

Also suggesting renewed emphasis on non-interstate routes after 1972 was A. E. Johnson, Executive Secretary of AASHO. Like McMorran and Cooper, he pointed out that these routes would be carying 80 percent of future traffic and have not been modernized to keep pace.

Expansion Is Sound Economics

A different view of the future federal aid picture was advocated by State Senator Randolph Collier of Yreka, the only state legislator to address the conference. His proposal was to expand the interstate system, "because it is sound economics to do so." The system, he said, must "grow with the growth of the country"; as an example, he noted that California's freeway and expressway system contains almost six times as much mileage as the State's portion of the interstate system, and most of it would have to be built to interstate standards.

Undersecretary of Commerce Clarence D. Martin, Jr. also expressed the need for planning for the post-1972 highway program, calling attention to an anticipated increase of 40 to 50 million people in the nation in the next 12 years. Higher incomes, more leisure and more interest in mobility will also be in the picture, adding up to increasing demands on the new highways.

One point about federal aid which all speakers who mentioned it were agreed on: under no circumstances should federal highway funds be allocated for maintenance.

Instead of talking about the interstate program, as he has done in appearances before highway officials in recent years, Federal Highway Administrator Rex Whitton concentrated on safety and "spot corrections." He called attention to the attack now being stepped up by many states on the problem of hazardous locations on highways not scheduled for major improvement in the near future, where lane widening, channelization, removal of roadside obstacles

d other small-scale safety projects
n help appreciably to reduce the
tion's toll of traffic deaths which
ıched 43,400 last year.

Other Aspects

Among the other aspects of high-
ıy operation, development and ad-
nistration touched on by these and
her major speakers were:

Specifications—Praise for the newly
ıblished AASHO guide specifica-
ons for highway construction was
upled by Contractor Maurice Tan-
r of Phoenix, Arizona, with a plea
the states to adopt them "at least
spirit" and for more cooperative
ommittee effort between highway
partments and contractors on the
ıte level.

Truck Weights – Johnson urged
ritical consideration" of proposals
increase AASHO's recommenda-
on of 32,000 pounds permissible
aximum for tandem axles to 36,000
ounds. Senator Collier, however, felt
at Western states should work for
ch an increase because of the West's
eater dependence on truck trans-
ortation.

Urban Planning – Undersecretary
lartin urged communities to take
eater initiative in complying with
ıe urban transportation planning
ovisions of the 1962 Federal Aid
ighway Act, and urged those areas
hich have lagged in the planning
rocess to speed it up so as not to
elay federal aid highway construc-
on in their jurisdictions.

Training—AASHO has established a
ew committee on management and
aining, Johnson reported. Its pur-
ose is to assemble and exchange data
n management techniques and spe-
ialized training.

Research—D. Grant Mickle, execu-
ve director of the Highway Re-
earch Board, gave a rundown on the
rogress being made to date under
National Cooperative Highway Re-
earch Program and other research
rograms, and stressed comprehensive
ransportation planning as a major
rontier for future research efforts.

The next WASHO conference will
e held in Santa Fe, New Mexico.
The date has not been firmed up, but
t is expected to take place in June
965.

HEWES AWARD

Continued from page 19 . . .

ity." This paper contains the practical results of more than seven years of observations and research in freeway traffic flow and is acknowledged to be one of the most comprehensive and useful compendiums of information in this field which is available. It was presented to AASHO (Committee on Design) at the 1962 annual meeting and to the Highway Research Board in January, 1963.

Two of Moskowitz' more recent reports have been in the increasingly important area of the overall transportation complex in metropolitan areas. The latter of these, "Living and Travel Patterns in Automobile-Oriented Cities," was presented in October, 1962, at a national symposium in Detroit and has since been widely quoted and reprinted for its practical approach, in human terms, to the hitherto highly theoretical problem of personal transportation. (See page 47 of this issue.)

Is ITE Officer

Moskowitz is a long-time member of the Institute of Traffic Engineers, and recently stepped up from the vice-presidency to the presidency of its Western Section. He is also a member of the American Society of Civil Engineers and of several committees of the Highway Research Board.

The Hewes award has now gone to Californians four times. A cowinner in 1952 was J. T. McWilliam, in recognition of his devising methods for using tabulating machines to process the field notes obtained with gyroscopic equipment. Division Communications Engineer Arnold H. Carver was the recipient in 1954, based on his leading role in developing a statewide highway communications network. And in 1962, Senior Bridge Engineer Roger D. Sunbury and Senior Engineer Welding Technologist Paul G. Jonas shared the award for their joint contribution to the design and use of high-strength steel in large highway bridges and the related development of arc welding.

Alfred E. Heller Is Named to Commission

Alfred E. Heller, Nevada City publisher, was appointed to membership on the California Highway Commission by Governor Edmund G. Brown on July 20, 1964.

Heller succeeds Arthur T. Luddy of Sacramento, who was appointed by Governor Brown in January 1959 and reappointed for a four-year term in

ALFRED E. HELLER

January 1963, but who resigned in July of this year because of ill health which prevented him from attending commission meetings.

Heller has been publisher of the Nevada City *Nugget* since 1959, and is president of California Tomorrow, a research organization concerned with problems of California's continuing growth. He is co-author, with Samuel Wood, of *California, Going Going . . .* and *The Phantom Cities of California.*

A native of San Francisco, he attended the Putney School in Vermont and was graduated from Stanford University. He served in the U.S. Army from 1952 to 1954, including duty in Korea.

Heller's home is in Grass Valley.

Urban Planning Progress

By C. G. BEER, Urban Planner

Recent actions in the San Francisco and Los Angeles areas highlight continued progress toward cooperative transportation planning by all units of government in urbanized areas of the State.

On June 5, 1964, the Bay Area Transportation Study Commission appointed Richard M. Zettel of the Institute of Transportation and Traffic Engineering, University of California, to the position of Study Director. He will supervise the coordinated nine-county study called for by the State Legislature which created the "BATS" Commission in 1963.

On July 2, 1964, the Advisory Committee of the Los Angeles Regional Transportation Study approved a proposed agreement which will be submitted to cities, counties, and State agencies in a five-county area. This agreement will formalize activities which have been carried on under the informal "LARTS" organization since 1960.

Comprehensive Planning

The Federal Aid Highway Act of 1962 states the congressional intent that after July 1, 1965, the Secretary of Commerce shall not approve for federal aid any highway projects in urban areas of more than 50,000 population unless such projects are based on a continuing comprehensive transportation planning process, carried on cooperatively between State and local communities. (See "Urban Planning," *California Highways and Public Works*, March-April 1963.) To date three urbanized areas in California have been approved by the Bureau of Public Roads of the Department of Commerce as qualified by cooperative agreements and established planning processes which meet the terms of the Federal Aid Act.

First of the California urbanized areas to qualify was Fresno. The Fresno Area Transportation Study (FATS) had been operating informally since 1961. To meet the specific regulations of the Federal Aid Highway Act a formal agreement between the City of Fresno, the City of Clovis, Fresno County and the State Department of Public Works was executed, and Bureau of Public Roads approval was secured in March 1964.

Similar Agreements Executed

Next, the Santa Barbara and San Diego urbanized areas executed similar agreements. The Santa Barbara organization is referred to as the South Coastal Transportation Study (SCOTS) and involves the City of Santa Barbara, Santa Barbara County and the State Department of Public Works. The San Diego urbanized area, like the Fresno area, had pioneered such cooperative planning for many years. A formal agreement to meet the requirements of the Federal Aid Act was prepared largely through the efforts of the City of San Diego, and has been executed by San Diego County, 12 cities, San Diego Unified Port District, and the State Department of Public Works.

Other urbanized areas in which organization and agreements are being processed are Sacramento, Stockton, and Bakersfield. Although not quite up to the 50,000 population which would bring it under the present requirements of the Federal Aid Act, the Eureka area in Humboldt County has organized a similar procedure.

Cooperation Is Stressed

The purpose of all these efforts is to achieve maximum compatibility of highway transportation networks with local land use plans and rail, air, and water transportation systems in urban areas by means of cooperative long-range planning. The Federal Aid Highway Act will affect the availability of more than $250,000,000 per year in Federal highway financing for urban projects after July 1, 1965. These funds play an important part in present programs for improvements on the Interstate as well as the State primary and county secondary road systems.

NEW LEGISLATION TIGHTENS CONTROL ON BILLBOARDS

Tighter control regarding commercial billboards located along State highways will go into effect on May 15, 1965, when the Collier-Z'berg Act becomes operational.

The new legislation (Senate Bill No. 44) will prohibit some types of billboards along particular stretches of the Interstate System.

It will double the general license fee from $65 to $130. Structure permit fees will increase from their present $2 level to $5.

Owners of signs adjacent to landscaped freeways will benefit from the legislation, however, for it extends the removal period for signs now in place from the present one year limit to three years.

Rules and regulations will be promulgated by the Director of Public Works.

The Director is authorized to enter into an agreement with the Secretary of Commerce to obtain additional federal funds for which the State becomes eligible through provisions of the act.

HR 381

Results Summarized in Report to Highway Transportation Agency

The continuing growth in motor hicles in California is assuming the oportions of a tidal wave; and when does, California state agencies con-rned with motor vehicle ownership d use hope to be prepared.

The Legislature started to probe e problem of the phenomenal owth of automobiles using the ate's highways and freeways in 1959. ouse Resolution No. 381, calling for study of state functions bearing on the motor vehicle, was adopted en; and now, the results of this ree-phase study have been summa-ed in a comprehensive report to the ighway Transportation Agency.

The report points out that the olden State is heading rapidly into expansion of motor vehicle traffic yond anything the world has ever nown.

Forecast for 1980

In 1962, state-registered motor ve-cles numbered 9,500,000. By 1980—short 16 years from now—projec-ons indicate that there will be a gain 8,000,000 vehicle registrations for a tal of about 17,500,000 vehicles in e State. In terms of annual travel ileage, the 76,000,000,000 vehicle iles chalked up by 1962 drivers in alifornia will have burgeoned to a aggering 200,000,000,000 miles in 980.

Fortunately, California has a highly celerated highway development pro-ram, and planning and programing or this first-rate highway plant extend r into the future. To complement ie physical plant, however, it is nec-ssary to find means of fully utilizing ie facilities that will be available. The ew problems which increased traffic ill bring to the highway user must e solved. The state agencies involved the care of the motorist must meet ie responsibility of providing effi-ient, safe, and convenient motoring. The question which must be answered : How can this best be done?

Factual Approach

The development of a factual approach to future traffic demands was also of concern to the U.S. Bureau of Public Roads, and their financial assistance toward the study indicated that this State's findings would be of national interest.

Out of the study, which enlisted the aid of more than 250 individuals, representing the Legislature; state, federal, and city administrations; private business; and the public, have come suggested improvements in five areas: Driver Licensing, Financial Responsibility, Highway Patrol Supervision and Services, Highway Traffic Operations, and Vehicle Registration and Titling.

Directed by the Automotive Safety Foundation of Washington, D.C., with Louis R. Morony as Study Director, the planning report sets forth 27 recommendations requiring legislation, 75 suggesting administrative refinements, and 25 revealing areas where further research and study are needed.

Recommendations Listed

Briefly stated, the recommendations of the study include:

- Establishing a sufficiently large staff of driver improvement analysts to work with problem drivers, using driver improvement schools to reeducate those with poor driving habits.
- Requiring every person 18 or under to complete a driver education course prior to being licensed, and ultimately requiring all beginners, regardless of age, to complete such a course.
- Broadening the functions of the Highway Patrol to include more rapid assistance to the disabled vehicle, removal of traffic hazards such as spilled loads, and rapid clearing of accident scenes.
- Developing a plan for emergency closing of freeway entrances and exits by using remotely controlled electronic devices.
- Expanding the information and education programs to provide additional education to benefit the motorist.
- Establishing research in areas of state government (relating to motor vehicle ownership and use) where there have been few depth studies aimed at increasing factual data.
- Implementing automation and electronic data processing equipment for immediate identification of problem drivers on a statewide — and eventually nationwide — basis.
- Starting a cadet training program whereby Highway Patrol candidates begin an apprenticeship at age 19 and enter the Academy for Traffic Officer training at age 21 after completing two years of preliminary assignments.
- Providing the Patrol with fixed-wing planes and helicopters for more efficient surveillance of traffic conditions.
- Investigating the possibility of automobile registration for the lifetime of a vehicle.

A limited number of copies of the report summary are available upon request from the Highway Transportation Agency, 1120 N Street, Sacramento.

NEW BRIDGE TRAFFIC HIGH

For the third consecutive month, a new traffic record was set on the San Francisco-Oakland Bay Bridge.

On Friday, June 12, a total of 152,073 vehicles crossed the bridge in a single day. The previous high of 148,137 vehicles was made on May 8, 1964.

During the first five months of 1964, a total of 18,889,872 vehicles have used the Bay Bridge, an increase of 9.4 percent over the comparable period of 1963.

Improving the Redwood Highway in Marin County in the vicinity of San Rafael. This photo was made in March, 1916.

The Redwood Highway

Part II — *Building the Road*

By JOHN ROBINSON

The automobile driver today who speeds in almost carefree travel along our modern highways is often completely unaware of how close behind him is the age of the horse. Although railroads and canals were doing much of the long haul freighting in the country by the middle of the 19th century, all other hauling was done either with horses, mules or oxen. In the 1880's the United States had literally millions of draft animals.

One authority points out that at this time there were more than 100,000 mules and horses being used exclusively on city street car lines. A public transportation company in a large city realized several thousand dollars annually from the sale of manure alone!

In California, transportation was several decades behind the eastern part of the United States. It had been exclusively a cattle country until about 1850, with almost no centers of population, and travel was mostly on horseback.

Despite its rich mines and great acres of productive farm land, the State had not developed a strong tax base even by 1900. Although one of the largest of the United States, it was relatively poor. The few well populated areas in California got first attention for roads, with most of the financing for these roads coming from the county treasuries. The rich counties had good roads, the poor counties had poor roads. In general, of course, the poorer counties also had the most formidable terrain.

There was little coordination of systems. Counties brought their roads up to the county line and stopped. There was no standard maintenance procedure. Signing was crude, amateurish and usually only of local value.

Dissatisfied with this way of building roads, the people of California began to think in terms of a state system. Earlier efforts had been confined to the trans-mountain routes, and one "Redwood Park State Road", which went through Santa Clara, San Mateo

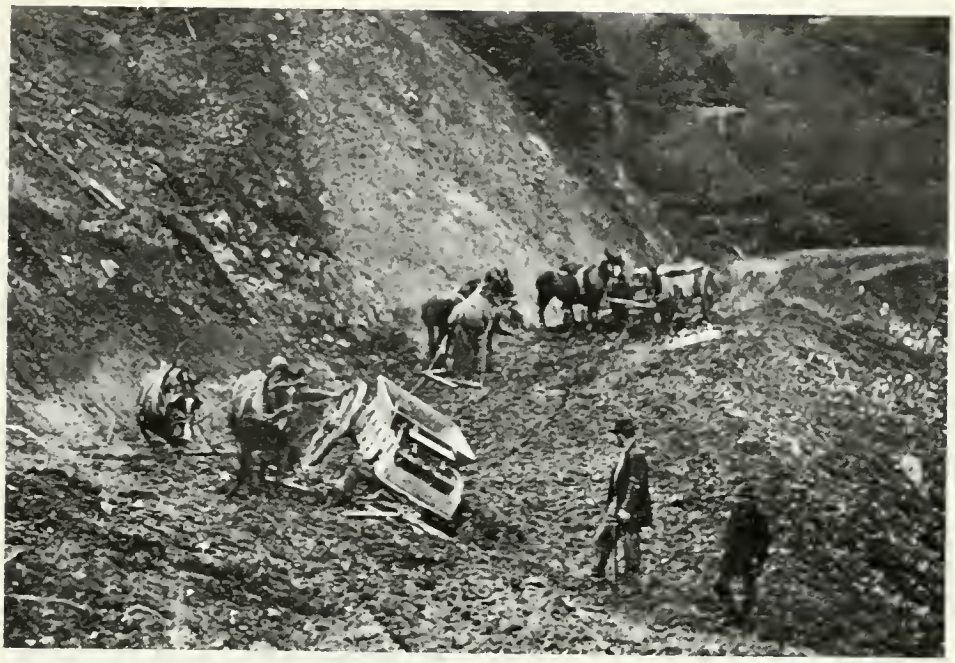
nd Santa Cruz Counties. The road as required to go through "Saratoga Gap" and through the Santa Cruz mountains to the "California Redwood Park." This is now Big Basin tate Park.

On November 8, 1910, the Governor signed the State Highway Act, to e effective the 31st of December, 910. This was in response to growing ressure for a state system, and an utcome of the "good roads" movement which was spreading over the ntire United States with the advent f the automobile.

The act said the state system ". . . all be constructed . . . at a cost not exceed $18,000,000 . . .". The oney was to come from 18,000 suitble bonds issued by the state governent in the denomination of $1,000. ated the 3d of July 1911, they bore terest at 4 percent, and were numered from 1 to 18,000. The first 400 these bonds were to fall due in ly, 1917, and succeeding blocks ch year thereafter. Sale was to be der direction of the Governor and roceeds went into the State Highay Fund. (The final block of this ue was redeemed in 1961.)

The act called for construction of system of "highways . . . permanent nature . . . finished with oil or acadam . . . or such other material ." as might be judged suitable by e engineers. An act also was passed r organizing highway districts and r the provision of maintenance nds.

Of this $18,000,000 first issue of lifornia Road Bonds, the State man-



Construction mishap in Sonoma County in the Healdsburg area, in 1914. Establishing a stable road foundation has frequently been a problem on the Redwood Highway.

aged to sell only $4,280,000 worth. The counties had to subscribe for the rest. Humboldt County subscribed $600,000, Mendocino County $445,000, Sonoma County $220,000, and Marin County $150,000. Sparsely settled Del Norte County was not able to buy any.

As soon as the money was available the neglected north coastal area road began to get attention. One of the first contracts let in 1912 was for grading from the south Mendocino County line to Hopland. Another was let for paving with asphalt almost 14 miles of the road from Healdsburg to Santa Rosa. Several other contracts were let but these were the two largest. By 1914, of the 381.2 miles between Sausalito and Crescent City, 111.6 miles had been surveyed or survey was under way.

The surveys themselves represented tremendous effort. There were no roads for the surveyors to bring in their equipment and it had to be brought in to their tent camps by pack horse. Sometimes the slopes along the route were so steep that the surveyors could not even use animals to carry their equipment but had to pack it on their own backs. Often they had to feel their way around the side of perpendicular cliffs, where

ow: View of the old Bell Springs Route, here at about 4,000 feet altitude running along the top of the ridge. This road was the only route from the 1870's until about 1920. It can still be travelled in good weather.

Survey crews fording the Eel River while laying out the original Redwood Highway route through the South Fork Canyon.

later a ledge would be carved out to carry the new road.

Although early road surveys had shown the road should go through the main fork of the Eel, this was no longer possible because the railroad had already gone down this canyon. Were a road to be located down this canyon when the railroad had already taken all the best sites it would be prohibitively expensive. The only other feasible route was the South Fork, which was somewhat less difficult, though longer.

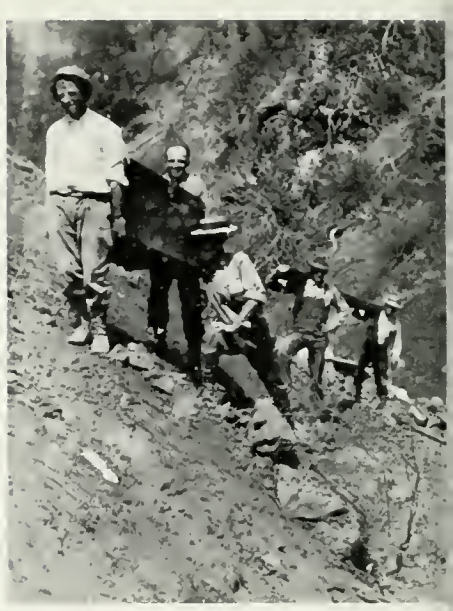
The railroad actually beat the highway into Eureka by several years. The San Francisco *Chronicle* on October 24, 1914 carried a story headlined "Whistles Shriek Joy While Crowd Applauds a Great Undertaking. Miss Alice Palmer christens the new line with bottle of California champagne." One paragraph of the story read "Engineers, shovelmen and tunnelmen, who in seven years built the level pathway along the granite wall of the Eel River Canyon and straight through the rock of jutting promontory, held it their railroad. . . . Financiers, who paid the bills at the rate of $25 for every inch of the 105 miles of the 'gap' that has been filled, doubtless acquired some legal interest in the property; but today Eureka and Humboldt County took possession."

Message by Smoke Signal

The final linkage point was 80 miles south of Eureka near the county line. Suitably, the message was carried to the outside by smoke signals. Three hundred celebrating people left San Francisco that day on the 7:15 a.m. ferry to take the "Sequoia Special," which had steam up and was waiting at the Sausalito ferry landing. They triumphantly rode northward past cheering crowds at Santa Rosa, Ukiah, Willits, and Asti. Luncheon was served on board. Then they left the more level southern country and began the climb into the mountains and through the rugged canyon.

Unfortunately they didn't quite make it on schedule. About 50 miles south of Eureka the Eel Canyon gave warning of its future actions by dumping a slide 300 yards long on the tracks, delaying them a whole day. When they finally made their way through Fort Seward, Shively, Scotia, Alton, Fortuna, Fernbridge, Lolita, South Bay and triumphantly into the terminal city on Humboldt Bay, the huge whistles of the logging mills blasted forth great shouts of welcome.

Although on November 7, 1916 California voters okayed, nearly four to one, a new bond issue of $15,000,000 for state highways, work on the Redwood Highway fell off because of demands in other parts of the State. In the years 1915-1916 Humboldt County only got 6.93 miles graded, Del Norte County, none; Mendocino County, none; Marin County, none; Sonoma County, 8.12 miles graded and 7.01 miles thin asphalt surfaced. However, the new Eel River bridge south of Scotia, no mean undertaking, was completed in June 1916.



Survey crews here moving camp while developing the South Fork route. Terrain was so rugged animals could not get through.

"Kennedy's Survey Party" in camp near Leggett in 1913.

People Eagerly Await Road

Nevertheless, there were always a few contracts underway, and the work went ahead month by month while the northern county residents anxiously awaited its completion. In 1916 the *California Highway Bulletin* said "It is doubtful whether the completion of any stretch of road in the State is looked forward to locally and also by the general public with more eagerness than the gap between Cummings and the Humboldt County line, a distance of 29.3 miles . . . as this change in route of the San Francisco overland road means the elimination of 2,686 feet of heavy grades, its importance may be readily conceived . . . construction entails the erection of several bridges of permanent nature, among which are Cedar Creek Bridge, 350 feet in length, 135 feet in height; Rock Creek Bridge, 210 feet in length, 145 feet in height; and the two crossings of the South Fork of the Eel River, each 350 feet in length . . . the country traversed is in a virgin state, for the most part devoid of wagon roads or even passable trails except those made within recent years by the state highway surveyors . . . the scenery is unsurpassed in California and the Redwood forests. River views and picturesque ruggedness will be a revelation to the tourist."

The *Bulletin* had this to say about the old route, the notorious Bell Springs Grade. "After the first rains come which generally occur in October, this road is impassable for motor vehicles and even for horse drawn vehicles. When snow storms set in, transportation is limited to saddle and pack animals." (This was in the year 1916.)

Twenty and Thirty Percent Grades

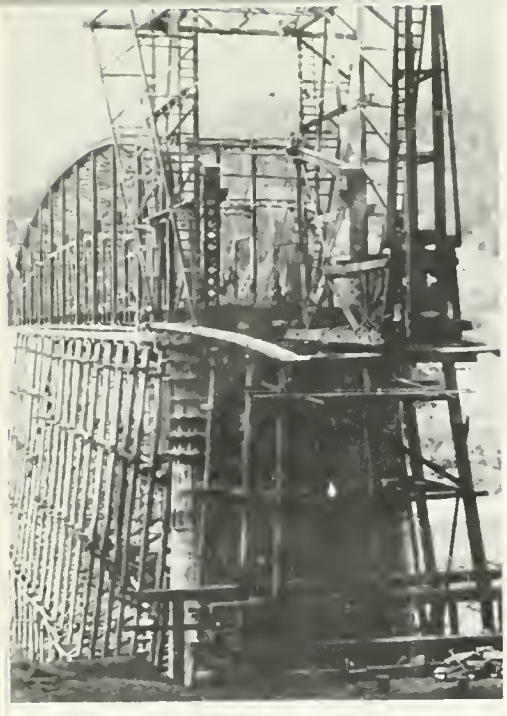
"The beginning of the ascent on the south slope is at Cummings, a post office at the foot of 'Rattlesnake Grade'. The elevation is 1,414 feet. A climb of 2,686 feet is made up and down grades exceeding 20%, to the summit, which is distant 12 miles, to an elevation of 4,100 feet. From this point a descent of 3,937 feet is made on up and down grades, some of them as high as 30 percent, to the town of Dyerville, distant 46 miles from the summit, elevation 163 feet."

View of the Redwood Highway north of Petaluma in March, 1916.

Above: The Redwood Highway, looking south through Garberville, Humboldt County, in 1914.

Below: The Redwood Highway just south of Crescent City in Del Norte County. Grade at left is 10 percent. Photo made on Lincoln's Birthday, 1915.

One of the factors affecting road construction during World War I was the stiff control exercised by the War Industries Board, which made it very difficult to ship highway materials. Furthermore, labor was scarce, since wages were high in the industries constructing ships and other war materials. During 1917 contract costs rose from 40 to 60 percent. Many contractors suffered and many contracts were completed at a loss to the contractor. As a result, in 1918 about 80 percent of the projects were



South Scotia Bridge, Humboldt County, under construction. Note falsework of local timbers. Photo made October 28, 1916.

Mechanized equipment used on a job in early days of modernization of Redwood Highway near Cummings, Mendocino County. Note right hand drive on trucks, and loads of hay for mules and horses.

deferred. However, California did much better than east of the Rockies, where road building was stopped almost completely.

California had one advantage in its Convict Act of 1915. This law allowed the State to use certain trusted convicts on road-building jobs. During the war these men were used quite effectively on several roads, including the Redwood Highway.

Best Convict Camp

The Mendocino County camp was considered the best of all the camps used on various jobs throughout the State. During the war when free labor was commanding about $3 per day, the cost of convict labor per "effective man day" at this camp was $2.53. This figure included the cost of their food and lodging, overseers, and all other necessary equipment and supervision.

In Mendocino County the use of convict labor started early. The law was effective in August 1915, and by September the first camp of 30 men was established in the northern part of the county. Ultimately the work was expanded to several camps of 125 men each, working year-round, every day but Sunday, in an area where annual rain and snowfall was 70 inches.

Materials Via Westport

When construction was started on the South Fork of the Eel, there was no adequate road connection in either direction through what was literally virgin wilderness. An emergency haul road had to be built from Leggett Valley to Westport. Here was a little harbor where steamers could enter in good weather and unload supplies which then were hauled in wagons over the interminable ridges to the South Fork canyon.

The first two years of the work were entirely by pick and shovel. When a trail was finally pushed through to Cummings, teams were brought in to help. In 1918 the first steam shovel got on the job.

But progress, although slow, continued. By 1918 paving was completed from Sausalito to Healdsburg and on

Double arch bridge with trusses made of wood, under construction at Rock Creek, Mendocino County, 1916. Note legs of tower on far bank, used to support lines for transporting materials into position. Bridge was replaced by a concrete one in 1930's.

about 10 miles of highway in the vicinity of Ukiah. Despite the war and the terrain, most of the route north to Dyerville was either graded or under contract. There was a 10-mile section finished from Eureka to Arcata, but from Arcata north to Crescent City the route was still only in a proposed state. Beyond Crescent City there was nothing even proposed!

During this same period, what we now know as US 99 was virtually complete from Red Bluff to Los Angeles. El Camino Real was complete from San Francisco to San Diego.

By 1920 there was a passable road between Sausalito and Eureka, but as late as 1925 there were still long stretches which were unpaved. In 1923 the road between Crescent City and Grants Pass was designated US Highway Route 199 and included in the Forest Highway System. The Bureau of Public Roads made considerable improvement on the old Gasquet route between 1924 and 1926. In 1926 the State improved and realigned a sizeable piece and took over maintenance of the entire route to the Oregon line.

Early type earthmoving equipment used in Del Norte County construction. Note that engine burned wood.

Above: Bar at Big Lagoon in 1920's was so high, lagoon could not drain into sea, and water rose to level of causeway, necessitating drainage ditch to get water into ocean.

Smith River Rampages

The State had just opened the first part of this route when the Smith River rose to the highest level ever recorded. Many sections of road were completely washed out. Fills built at great labor were swept away. Even at prices prevalent in those days repairs cost several hundred thousand dollars.

A great portion of the section between Arcata and Crescent City had had no work done on it at all by the mid-1920's. In 1924 a survey was made of highway bridges needed in the State. These were indicated on a map with a little black circle where each bridge was needed. It made this section look like a bunch of grapes, with barely room for all the circles. Crossings at these points were still being made as at the Klamath River by primitive ferry, or fording.

From the mid-1920's, the story of the Redwood Highway was the careful husbanding of funds to complete the unpaved sections, and the grading and paving of those sections on which no work had yet been done. By 1930 the entire highway had been "improved." Unfortunately, these "improvements" were to standards based on surveys made prior to World War I!

In the 1930's most of the work on the Redwood Highway consisted of widening and realignment. A typical project was a 9.32-mile section in Del Norte County which was realigned at

Below: Power shovel working at Alder Bluff in Del Note County, not far from the Humboldt County line, about 1925. Cut must be made 32 feet deep here to get bench wide enough for narrow two-lane road.

Orick, northern Humboldt County, about 1925. Vehicle stopped at past office is "stage" running between Crescent City and Eureka at that time. Note big wheels and high clearance. Gasoline in more primitive areas at that time was hauled in steel drums seen at extreme left, and attached, a drum at a time, to pump at service station. Signs say "Orick Past Office," "Notary Public," and "Orick Cash Store."

a cost of a little more than $700,000, eliminating 205 curves.

There were a number of similar projects indicating that the days of contracts for a few thousand dollars were past. Million-dollar jobs were by no means uncommon and with the tremendous increase in automobile traffic the constant pressure for expenditures all over the State prevented improvement of any large sections of Redwood Highway mileage. Even today there are many miles of this original alignment, built for 20-mile-an-hour traffic, still in operation.

Nearly all of the bridges constructed on the first alignment were of timber and had to be replaced in the 30's not only because they were beginning to be structurally unsound but also because they were of inadequate design for later traffic needs. In 1917, when many of these bridges were built, the problem of getting steel to the site was almost insurmountable. It was customary to buy timber near the site, and bring in a portable sawmill with which to cut the necessary bridge members.

Perhaps the biggest single change in the Redwood Highway was construction of the Golden Gate Bridge. It was dedicated in May 1937 and opened during 11 days of "revels, pageantry, parades, and civic demonstrations—thrilling shows on land, water and in the air."

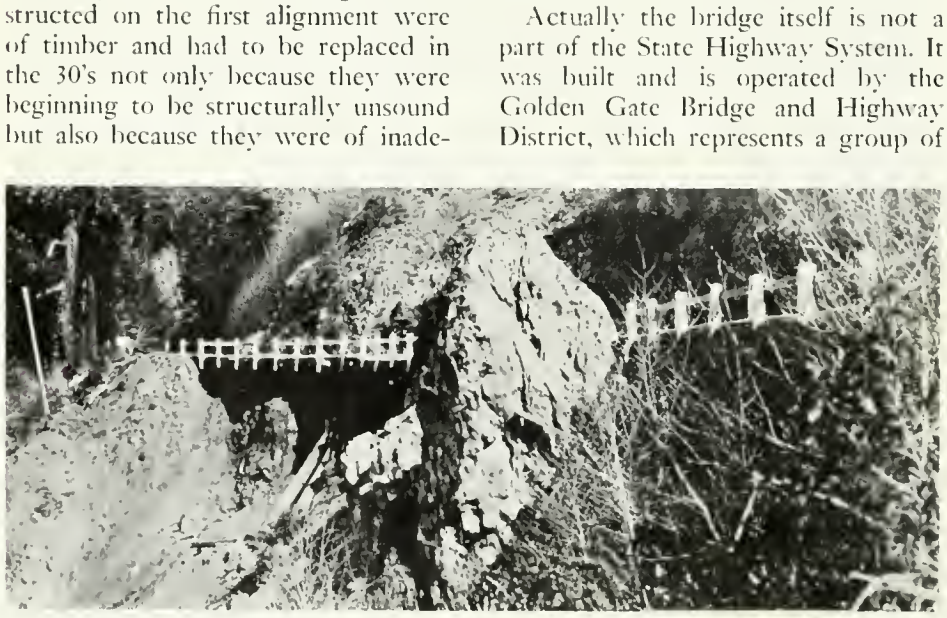
Actually the bridge itself is not a part of the State Highway System. It was built and is operated by the Golden Gate Bridge and Highway District, which represents a group of counties. Cost of the bridge was about $35,000,000. Today this amount would hardly build the abutments.

The Division of Highways designed approaches on both sides and did the engineering work for the tunnels at the top of the Waldo Grade. The approaches were elaborate, particularly on the San Francisco side, but almost immediately the Marin County side was found to be inadequate because the traffic increase was much greater than anticipated.

This was by now true along the entire length of the route. Traffic loads were building up. Money which should have gone for realignment and modernization too often had to be used for stop-gap jobs. Still, many three- and four-lane sections were built, particularly on the southern end of the route, where there was already a hint of the rapid urban growth of post-World War II years.

Also, during the 30's the State took over Highway 1, now called "The Shoreline Highway". The necessity for construction of dozens of bridges on this route diverted sizable amounts of north coastal funds from the Redwood Highway.

During World War II, recreational highways and many secondary routes were ignored in favor of improvements on routes which were considered defense highways. To some extent the Redwood Highway was a defense route for protection of the



Section of Redwood Highway in Del Norte County, in March, 1931. To widen this section it was extended out on viaduct using 30-inch timbers 60 feet long.

coast but this was not given great weight in allocation of funds. Except for sections near defense facilities, very little improvement work was done during World War II.

By the end of World War II the Redwood Highway was farther behind the rest of the state system than before. Conversely, after the war there was a greater interest in recreation and driving. As soon as the factories retooled for peace-time production, automobiles crowded onto the highways in greater numbers than had been dreamed of in prewar years.

Because of expanding urbanization, interest in the outdoors increased in a sort of cultural claustrophobia. People wanted to travel, camp, hike, or just drive for pleasure. The redwoods had been publicized so widely and so often that they were internationally known and one of California's great attractions, so a great deal of this traffic found its way to the Redwood Highway.

All the State could offer this traffic was the tortuous and winding route which, although realigned and improved to 1930 standards in some places, was still dangerous and difficult to drive over much of its length. The tourist from the east was frightened by the tortuous curves along cliffs high above the river. He was exasperated by the twisting, winding route among the great trees which cut down

Measuring distance between trees on Redwood Highway in Richardson Grove vicinity, during checks for safe passing distances in 1930.

Klamath River Ferry at Requa, Februory, 1925.

Above: Damage was greot when the Smith River rose to unprecedented heights in 1920's just after the Crescent City-Stote Line section was taken into the state system.

Below: Flooded section of Redwood Highway near Humboldt-Del Norte County line, November, 1928.

Digging out road after cliff slid into ocean, Del Norte County, 1925.

on speed and caused long queues to build up behind truck traffic.

The trucks were another element in the problem. Until World War II the logging railroad was still carrying logs in many parts of Mendocino, Humboldt and Del Norte Counties. By the time the war was over, logging had moved into the interior, away from the railroads, and the modern logging truck with its greatly increased power and size was evolved. It could carry heavier and bigger loads, and was more mobile.

In addition, people were settling in the northern counties in greater numbers. They increased local traffic, and local truck traffic also increased to serve them. Just as the small railroads had disappeared from the scene, so had the small coastal schooner. Why handle cargo several times when the truck could deliver direct to the buyer?

Reconstruction over slide in Mendocino County in the Rattlesnake Summit area in late 1920's.

Even when powered equipment such as this Liberty dump truck could get to site, it could carry little more load than mules and wagon, and repairs after slides were slow and laborious.

As a final coup de grace to the old ›ad came the modern motor car with ; low center of gravity, low driver's at, and high speed. From a practical ewpoint the driver's visibility was ıt, while his speed was increased. ll over the country, this required ore carefully engineered highways. he Redwood Highway was no ex-ption. Its accident rate was building › every year.

In a very real sense a road today in ır fast moving technology is much ‹e the cars that use it. To the people ho live near the new road and those ho drive on it, it is a broad, shining mbol of modern science. But, in the ‹sign of the cars which use the road, ‹w ideas and new techniques are de-‹loped. So are better ways found to ıild roads. Traffic loads increase. he motorists themselves demand gher standards. A generation passes ıd the road is obsolete once more.

In those sections where roads were asonably well-developed before the lvent of the motor car which so dra-atically accelerated the pace of road ıilding, the road builders have been ›le to stay more or less even with e demand. In those places which ere undeveloped prior to the advent the motor car the problem has been ute. This has been true of US 101 in alifornia north of San Francisco.

(The third and concluding article this series will cover the post-Vorld War II development of the edwood Highway to date.)

sults of reversing curves were often the same in the 1930's as today.

This view of the old Ridgewood Summit road south of Willits in 1938 is typical of old "reversing curve" type of construction used in those days. Earthmoving was slow and costly, and road had to follow the contours. This road has been realigned and widened to four lanes, but many miles of the Redwood Highway still follow contours.

Above: Loss of considerable section of road due to slipout north of Cloverdale, Sonoma County. Stream is upper portion of Russian River.

Below: Rock slide in road, Redwood Highway north of Leggett, April 7, 1948.

Banks of the San Gabriel

Interstate 605 Will Serve Historic, Fast-Developing Area As Easterly Leg of Los Angeles Metropolitan Freeway Loop

By BARRY COHON, Assistant Information Officer

A few blocks north of the present intersection of Whittier and Norwalk Boulevards in the City of Whittier, lies the spot where the creation of the world began. So goes a recorded Indian legend.

Within sight of that venerable location, history is in the making again, with the completion of the first link of Interstate Route 605, a freeway paralleling the east bank of the San Gabriel River. Eight contracts, now in various stages of work, will provide an unbroken 23.4 mile artery by mid-1966, running from the San Diego Freeway (Interstate 405) in Orange County to the San Bernardino Freeway (Interstate 10) in Baldwin Park. Future noninterstate extensions northward and southward will add approximately another eight miles to a route known unofficially as the San Gabriel River Freeway.

This 30-mile freeway, costing over $60,000,000 to construct, will serve territories as varied and fascinating as any in the State. Beach playground, poultry and dairy farm, oil field, bedroom suburb, college campus, country club, and historical landmark—all line the route which will form the eastern portion of a huge loop around the Los Angeles metropolitan area.

First Completed Section

On June 10, Mayor Monte Wicke of Whittier prepared to cut the ribbo on the first completed stretch of th new route. Recalling his childhoo days in the area, he said: "I used watch them shooting Tarzan pictur down in the gully where this ne freeway crosses Whittier Boulevar Those were the days of silent picture They would water their elephants the river right alongside here, and used to ride on the elephants." He w standing on the northbound lanes Interstate 605, a few hundred yar north of Whittier Boulevard, with th San Gabriel River channel on h right. A few minutes later, he got in a new black sedan and led a motorca

Looking south along Interstate 605 Freeway near Rose Hills Road.

ver the spot where he had once itched a ride on an elephant.

Typical of the enthusiasm with which San Gabriel River Valley residents welcomed this new stretch of freeway, Assemblyman Joe Gonsalves of the 66th District addressed the dedication luncheon on his work with the Assembly transportation committee and the progress of the Freeway-Expressway system. Gonsalves, former mayor of Dairy Valley, has more than a passing interest in the value of the system, being the scion of a pioneer family in the entire dairy farming industry of Southern California.

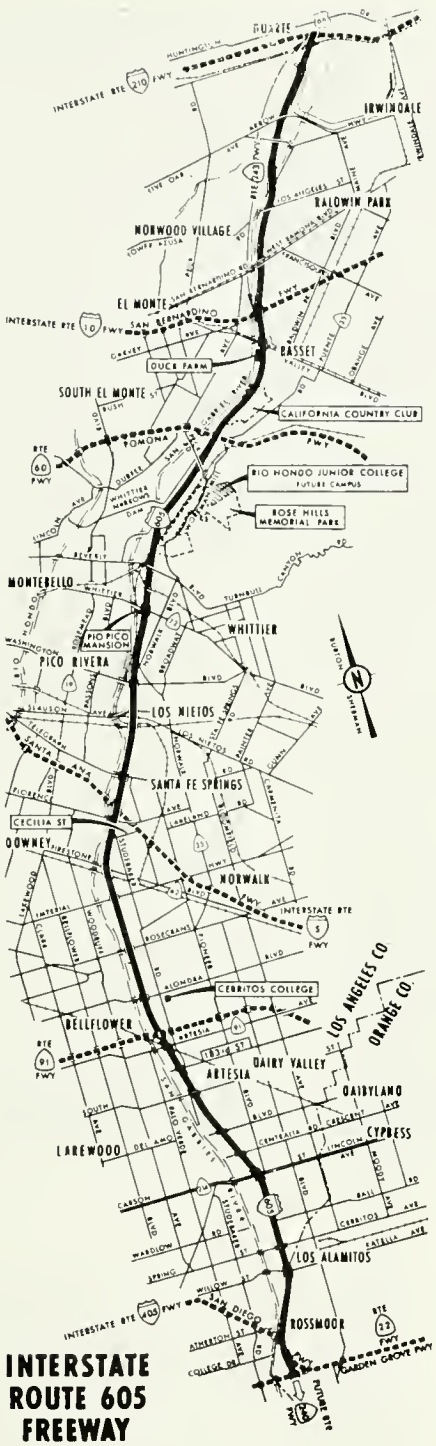
Discussing various aspects of the highway program, T. Fred Bagshaw, Assistant Director of Public Works, represented Governor Edmund G. Brown. He highlighted the importance of public acceptance and understanding of the freeway system on the statewide level, while Edward T. Telford, District Engineer, explained the function of Interstate 605 in the scheme of things for Southern California.

Picturesque Freeway

First link to be opened on Interstate 605 is a section between Whittier Boulevard and Peck Road extending for 3.3 miles in a cut-fill section overlooking the valley and the river. Resident Engineer, R. C. "Dick" Bek, who took over the job a year ago and saw it to completion, calls this section one of our more picturesque freeways. A smooth project in more ways than one, his job has a profilograph index of 1.6 —better than average—and Bek reports a good working relationship with the public, county officials and the Griffith Company, prime contractor on the construction of this $5.5 million project.

Featured on this section is more extensive use of aluminum glare shield than heretofore, both on curves and on straightaways.

Symbolizing the historical background of the Whittier-to-Peck section of the San Gabriel River Valley, the "mansion" of Pio Pico, last Mexican governor of California, stands as a state historical monument facing



what will be the Whittier Boulevard southbound onramp. The old adobe boasts a brick well in the courtyard, and a wine cellar stacked with ancient barrels (presumably empty). It attracts the student with its authentically restored interior rooms and its display of relics and documents from the Mexican period. It also attracts art classes from nearby Whittier adult high school to sketch its humble sprawling exterior.

Restoration Project

That exterior may change its appearance soon in a new restoration project based on research by Martin Cole, curator of the monument. Historical accounts of the origins of the "Casa del Governador" differed widely and Cole has been able to track down some of the authentic facts concerning this early California landmark and the man whose name it bears. Pio Pico built the adobe dwelling sometime after his wedding in 1834—exactly how long after remains in doubt. Old residents remember him in his eighties, still the dignified Don receiving visitors on the porch of his home.

What happened to the area around Pio Pico's mansion after he lost it to creditors in 1891? The County Road of those days became Whittier Boulevard, and the adobe saloon where one of Pico's sons was killed expanded to become Jimtown, a patch of substandard housing which has been all but wiped out by the new freeway.

Whittier Area

To the east lies Whittier, a clean and busy city of some 70,000 with a Quaker heritage. Gerald Hathaway, Manager of the Whittier Area Chamber of Commerce, calls Interstate 605 "something we have needed for a long time, namely a north-south highway facility that will eventually tie in with the San Bernardino and Santa Ana Freeways and relieve pressure on Highway 35. Of all the freeways constructed in this area, this is probably the most beneficial to citizens of Whittier, Pico Rivera and the surrounding communities."

By fall of 1964, Interstate 605 is scheduled to be open from Whittier Boulevard to the San Bernardino Freeway, affording sorely needed traffic relief to highway travelers in the eastern section of Los Angeles County and western Orange County. During 1965, the average traffic volume on this new seven-plus miles of Interstate Highway facility is expected to reach 45,000 vehicles per day.

Between raws af tract hauses in Narwalk, the cleared land af the Interstate 605 Freeway right-af-way extends narthward paralleling the San Gabriel Riv Bridges crass the river at Rasecrans Avenue and Imperial Highway.

Along the way, it will serve some interesting areas.

Radius of Service Extended

Flanking the freeway on the east is the Rose Hills Memorial Park. Averaging 15 funerals a day on its 2,750 acres of lawns, gardens and chapels, Rose Hills serves an area from Pasadena and Pomona on the north to Long Beach on the south. Joseph L. Seppi, one of the founders, estimates that the new freeway will extend the park's radius of service from 20 miles to 30 miles.

North of Whittier the California Country Club occupies 138 acres purchased by owner-operator Bill Bryant before Route 605 was adopted. After the freeway route was put through his land Bryant proceeded with his plans anyway and the club prospers today. An underpass connects the 16 holes of the golf course's main section with the two holes which lie west of the freeway. So, in effect, the golf course provides park-like surroundings for the freeway.

As it passes Rose Hills, the freeway skirts a large Victorian frame house where Mr. and Mrs. Joe Moynier hav been living for 30 years. Energet rancher Moynier came to Souther California in 1925 from his nativ France. He arrived in Los Angel with $7 and an address—that of countryman named Pellissier. The Pe lissier dairy farm was one of the olde and biggest in the Southland. After years with Pellissier, Moynier boug the ranch he still occupies, with its 1 room house. He describes the chang in the valley since 1940 as "pretty ne unbelievable." In the old days, the S Gabriel River was a torrent which

e ranchers joined forces to dam with gs and brush for irrigation. Moynier is president of the Rincon Ditch igation Company at that time. But ar by year, the damming job became ier, until they ran out of water. acts of homes began to replace wal- trees after World War II, and e "big push" came in the fifties. oynier sold the first section of his nch in 1955 for $5,000 an acre. At at price, he says, "I left $3,000,000 the table." From 1957 to 1961, the ate bought other parts of his land r the freeway.

Land Sold for Campus

His old bosses, the Pellissiers, sold me of their land for the campus of e new Rio Hondo Junior College. 1963 Rio Hondo J. C. separated om the high school district and ought in Dr. Phil H. Putnam as its perintendent and president. Today, ith a staff of 100 part-time teachers lding night classes in local high hools for 1,800 students. Dr. Putnam ans for a 1964-65 academic year rving 400 full-time students at an andoned grade school building, in ddition to 2,000 night students at rious other locations. This "holding operation" will continue until September, 1966, when the new campus is scheduled to be completed. Since the Interstate 605 freeway is also scheduled for opening at that time, the two facilities are closely associated in the minds of the voters, and of Dr. Putnam. "When I got here," he recalls, "I found that three bond issues for the campus had been defeated. One reason for it was that the only available site for the campus is located at the north end of the junior college district. I campaigned for the bond issue, using the freeway as a selling point, and on the fourth try it won." Bounded on the south and west by Cerritos Junior College District, the Rio Hondo district includes Whittier, South Whittier, Santa Fe Springs, Pico Rivera, and parts of Norwalk and La Puente—all served directly by the new freeway, which will bring the otherwise secluded campus within easy commuting distance for faculty and students in even wider-spread areas.

The adobe residence of Pio Pico once echoed to the music of guitars and a $12,000 piano—and at fiesta-time, to the laughter of senoritas like Connie Kopenec. Now it faces the Whittier Boulevard off ramp of the new Interstate 605 Freeway.

The California Country Club straddles the freeway north of Whittier.

Shipping Center for Valley

In 1940, Bassett was described as "a Puente Valley shipping point for oranges, lemons, walnuts, and vegetables." It had a population of 216. Today, busy Valley Boulevard and

Aerial view shows future Interstate 605 Freeway course northward through a corner of Downey. Southern California Edison Company installation is at lower left. The three bridges across the San Gobriel River show the locations of Florence Avenue, the Santa Ana Freeway, and Telegraph Road. Beyond Telegraph Road, the river divides Pico Rivera on the west from Santa Fe Springs on the east.

the San Bernardino Freeway form a triangle with the new 605 freeway to serve the rapidly growing industrial and residential traffic. Just to the west of Bassett between the freeway and the river, lies one of the world's biggest duck farms—the only one in Southern California. Here Mr. and Mrs. E. B. Bahnsen raise some 80,000 ducks to ship to local tables and also for export as far away as Hong Kong.

North of Bassett, in the 8-year-old city of Baldwin Park, some 41,000 people are making a residential and industrial city—the City Council calls it "Hub of the San Gabriel Valley"—out of a community with a rural and frontier heritage. On land once owned by the San Gabriel Mission, small farms, vineyards, chicken and cattle ranches flourished in the days of the town's flamboyant godfather, Lucky Baldwin. In 1878 there was a village here named Pleasant View, later renamed Vineland. Baldwin allegedly planned to eliminate this village by establishing a town of Baldwinville nearby. But while visiting Vineland, we are told, Baldwin slipped on the steps of a store and fell backwards into the arms of the proprietor's wife. Grateful to her for cushioning his fall he agreed to drop his plans for a rival settlement and told her "My name is yours to do with what you will."

Serves Heavily Settled Area

Southward into the communities of Pico Rivera, Los Nietos, Santa Fe Springs, and Norwalk, the new freeway will be serving heavily settled subdivision areas—7½ miles of backyards, bordering the freeway right-of-

y and the Edison Company's power
es.

Los Nietos, an unincorporated farm-
g and residential community, is
med for the Rancho Los Nietos.
anted in 1784 by Governor Fages
Jose Manuel Nieto, the rancho em-
ced all the land between the Santa
a and San Gabriel Rivers, from the
ountains to the sea—some 300,000
es.

After Nieto's death in 1804, the
nt became three ranchos owned by
heirs. In one of these, Rancho
nta Gertrudes, the villages of Pico
d Rivera sprouted. The two towns
ed up rapidly, and so did the vacant
d between them. In January 1958,
jorities of the two town's voters
cided to join, and the unhyphenated
y of Pico Rivera was born. Back in
e 1880's a flood diverted the San
briel River to its present channel,
ving the old channel to be renamed
e Rio Hondo; Pico Rivera lies be-
een them. In much the same way,
t in a reverse pattern, some of the
ffic now passing the town on the
nta Ana Freeway will be diverted
metime around the fall of 1965 to
e new Route 605 Freeway, thus
king Pico Rivera even more acces-

The San Gabriel River Freeway looking south from Rose Hills Road interchange with the Caterpillar Equipment Plant in left foreground.

80,000 ducks live by the freeway.

sible to industries like the Ford plant at Rosemead and Washington Boulevards, one of the town's principal employers . . . and to Pico Rivera's population of over 50,000.

Santa Fe Springs Origin

Moving from the Rancho Los Nietos south and slightly east, we find ourselves back on Pio Pico's former spread. Here in 1880, a certain Dr. Rogers dispensed mineral baths at his "Hydropathic Sanitarium and Congenial Home." In succeeding years, the Congenial Home and its permanent residents changed the community's name to Iron Sulfur Springs, then to Fulton Wells, then to Santa Fe Warm Mineral Springs. Finally the "warm mineral" was dropped, the town which was incorporated on May 15, 1957 as Santa Fe Springs, was honored in 1959 as an All-American City. Today it is primarily an industrial city of less than 16,000 population, roughly three-quarters of its land being zoned M-2. Hard-working orderly Santa Fe Springs has come a long way from the oil-boom days of the 1920's. In 1923, the petroleum pool yielded 79,000,000 barrels. In succeeding years, companies found it cheaper to import Arabian oil than to extract large quantities from the deep wells here. By 1962, quota-controlled productions from 478 active wells in Santa Fe Springs totalled 2,445,234 barrels. Other industries have been brought in to fill the gap, particularly during the last 10 years. Today's operators include Pacific Clay Products — largest plant of its type in the world—as well as food-market warehouses and meat processing plants, a trailer factory, and new plants under construction for the Illinois Tool Company and the Xerox Company.

Reg J. Reardon of the Santa Fe Springs Chamber of Commerce spends most of his time showing new industrial prospects the more than 4,000 acres of industrial land still available, and he looks to the freeways to enhance the value of this land to industrial users.

Norwalk Area Develops

Bedroom for the Santa Fe Springs oil workers of a generation ago was a cow-town called Norwalk, dusty in the summer and muddy in the winter and otherwise noted as a truck-garden region and site of a state hospital. The postwar wave of immigration that hit Southern California multiplied Norwalk's population 10 times and more by the mid-50's, and the cow-town was gone for good. Incorporated in 1957, Norwalk today boasts a population of over 90,000, goes in heavily for civic planning, and prides itself on the nickname "Keystone City."

Foreseeing future concentration of multiunit and even high-rise apartment buildings in this area, builders and developers count on the freeway network to bring people and wealth into Norwalk. The Santa Ana Freeway (Interstate 5), and future Route 91 Freeways all serve Norwalk, as well as Downey just to the west. Downey, named for the Civil War governor of California, John G. Downey, is one of the older settled communities of the area, both residentially and industrially.

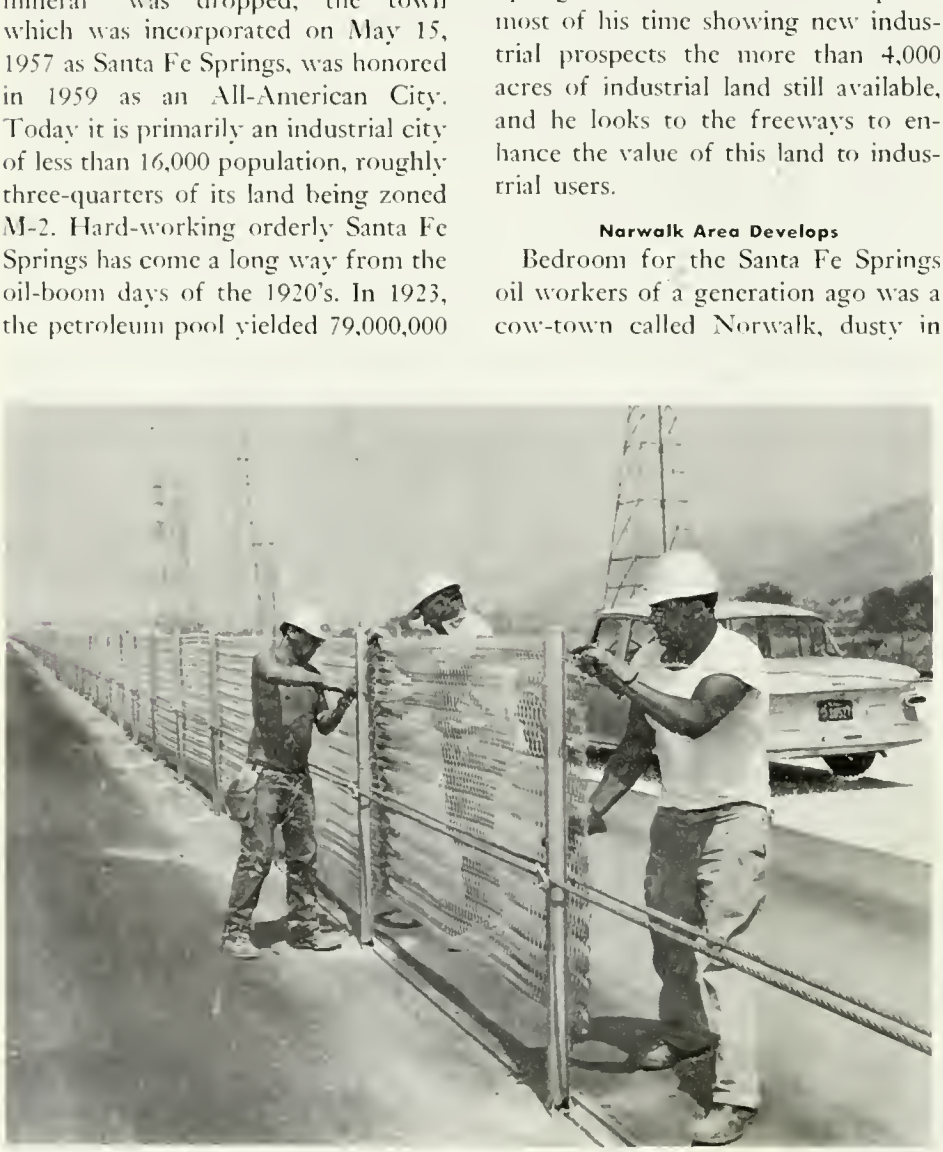
Threading its way between the river channel and Studebaker Road, the new freeway will serve drilling equipment firms in the Santa Fe Springs and Norwalk areas. Farther south, milk and education replace oil as staple industries.

A cow in Dairy Valley gives four gallons of milk per day, and may make her owner $1,000 a year. Incorporated in 1956, this city of less than 3,600 people has 100,000 cows, mainly black and white Holsteins. Its per capita wealth is the highest in Southern California. In effect Dairy Valley became a city in order to avoid becoming a "city." By incorporating, it can retain its agricultural character, limiting its residences to one every five acres, and thus protecting its rich dairy industry from the subdivisions which have engulfed areas all around it that once were devoted to farming.

Freeways' effects on Dairy Valley merited special mention in a recent report by Los Angeles *Herald-Examiner* writer Frank Lee Donoghue:

San Gabriel Freeway

"Bulldozers and giant earthmovers today are growling out their own song of Dairy Valley's future as the



Installing aluminum glare shield on Interstate Route 605. Shielding is designed so that motorists cannot see through it at the forward angle. Thus opposing traffic and its headlights cannot distract the driver.

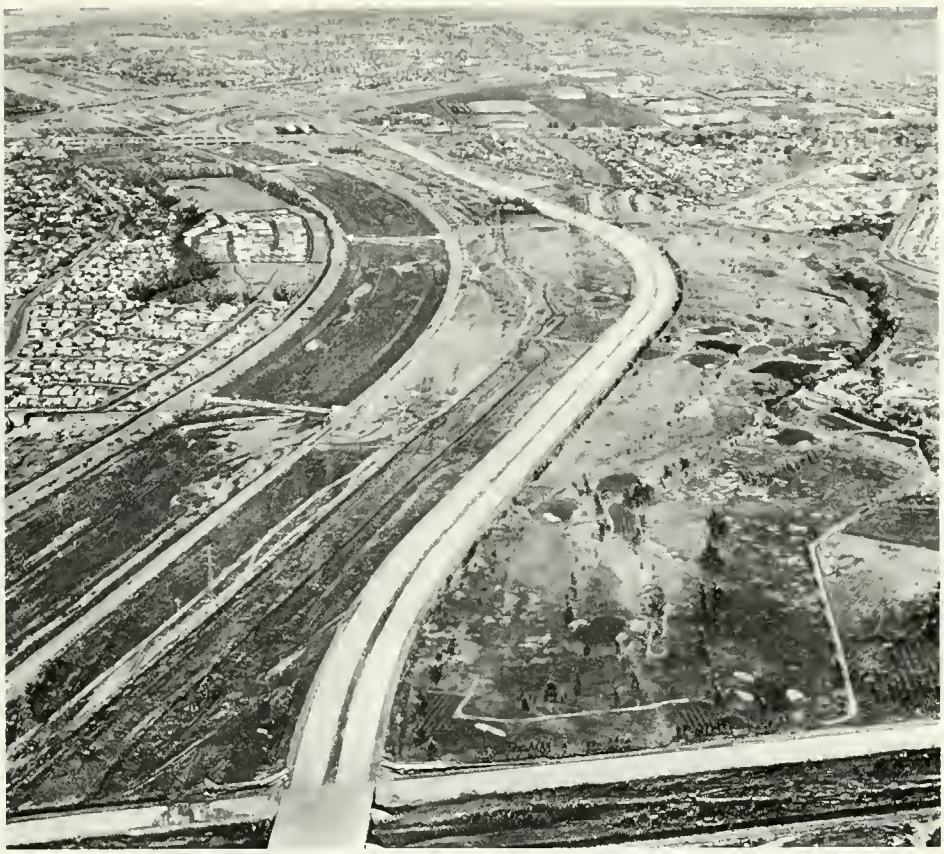
rth-south San Gabriel River Free-
y is being pushed through the no-
ger-sleepy cowtown. Completion
anticipated in another two years,
en work on the east-west Artesia
eway is expected to start.

'Dairy Valley, situated as it is on
Santa Ana Freeway, will become
nub city when the two new free-
ys become operative," said City
nager Bill Stark. "Most of the
ht-of-way for the Artesia Freeway
been acquired and clearing work
now going on. Our chamber of
mmerce is calling Dairy Valley a
eping giant.' That's a little over-
matic, but I must agree."

Looking out at a landscape of cattle
l cars is the ultra-modern campus
Cerritos College, facing the future
eway from the corner of Stude-
ker Road and Alondra Boulevard.
king up where its northern neigh-
r, Rio Hondo J. C., leaves off. Cer-
os' parking lots seem to require
re land than its classrooms, under-
ring the car-borne character of
lay's students. Like Rio Hondo,
rritos lies just east of the Interstate
5 Freeway and will benefit directly
m its service as soon as it is com-
ted.

First 'Contract City'

Spreading westward from the west
nk of the San Gabriel River, and
rthward from the San Diego Free-
y and the Long Beach line, is the
st of California's "contract cities"—
kewood. Incorporated in 1954 as
s Angeles County's 46th city, Lake-
od originated the plan of contract-
municipal services to the County.
the time this was an experiment
d became known as the "Lakewood
n" which has since found accept-
ce in many other smaller cities of
e state's most populous county,
king Lakewood somewhat of a
odel for students of city planning.
rgest employer of Lakewood's citi-
ns is the Douglas Aircraft plant. But
e commuting area is expected to
read much wider with the opening
the San Diego Freeway to the
range County line in mid-September
this year, the completion of the
terstate 605 Freeway to connect
th the San Diego Freeway in 1966,



Aerial view shows California Country Club and Ward Duck ranch in relationship to new freeway.

and the subsequent construction of the Route 91 (Artesia) Freeway.

At the south end of Interstate 605 in Orange County at Los Alamitos Boulevard, a twin interchange will connect it with the San Diego and Garden Grove Freeways. Bordering the stretched-out interchange, extensive new housing tracts spread all the way to the county line and across it.

Freeway Loop by Mid-1966

Completion of the freeway in this fast-growing area will open the 23.4 mile loop in mid-1966, enabling traffic of all types to circulate freely to, through, and around Los Angeles by connecting with all its other important freeways—directly with the operating San Diego, Santa Ana, and San Bernardino, and via them with the Long Beach, Harbor, Hollywood, and Golden State. Providing even broader traffic service in the future, Interstate 605 will connect directly with the already adopted Route 91 (Artesia) Freeway, which crosses the San Gabriel River just north of Artesia Boulevard in the Bellflower area, the Route 42 (Century) Freeway, which will feed into Interstate 605 near the Santa Ana Freeway Interchange, and the Pomona Freeway (Route 60, at South El Monte). Estimated daily volumes of traffic on the completed Interstate 605 Freeway in 1985 should have a magnitude of 125,000 vehicles per day.

Non-Interstate extensions of the San Gabriel River Freeway are planned for the future, both north and south of the termini of Interstate 605: Projected for construction in the next several years, is Route 243, adopted from the San Bernardino Freeway northward to connect with the Interstate 210 (Foothill) Freeway north of Irwindale. Route studies are now in progress on a southerly extension (Route 240) between the San Diego Freeway and Pacific Coast Highway, which would carry the San Gabriel River Freeway to the beach, making it the first direct mountain-to-ocean freeway in the Los Angeles area.

Seattle Public Library
SEP 8 1964

Correspondence

Committee Produces, Revises Stenos and Typists Handbook

"This manual has been developed in response to the need for uniformity in correspondence practices and other pertinent office procedures in the Division of Highways . . . to be followed in the Headquarters Offices."

Thus begins the new Foreword of the Stenographers and Typists Manual, as drawn up by the Headquarters Correspondence Practices Committee. This group came into being late in 1960, when the need for an authoritative office manual became apparent, and a group of selected secretaries and typing pool supervisors met to start the wheels in motion.

Discussing the agenda for a future meeting of the Headquarters Correspondence Practices Committee are Chairman Evelyn Zazzi of Personnel (second from left); Co-chairman Hilda Lima of Planning (second from right); and task force members Louise Hess, Administration (left); Marge Coy, Management Analysis (standing); and Winifred Higgins, Equipment (right).

Section Representatives

The various headquarters sections represented—and their *present* representatives—were: Executive Office, Margaret Mullenney, Margaret Long and Evelyn Zell; Personnel, Evelyn Zazzi; Office Engineers, Marian Knoth; Right-of-way, Eileen Lapham; Administration, Louise Hess; Planning, Vivian Brady and Hilda Lima; Bridge, Agnes Brownell; Materials and Research, Agnes Lyon; Operations, Dorothy Gullman; Equipment, Winifred Higgins; Accounting, Ava Kirk; and Management Analysis, Marge Coy. (Recently Service and Supply has also been represented by Tom Biagioni.)

Their meeting resulted in a listing of specific areas not covered by existing instructions, such as circular letters and headquarters office instructions, and discussing the best method of handling these situations. The extent to which correspondence practices should be uniform among offices was also discussed, and a draft of instructions was developed.

Manual Is Issued

In January 1963 the Division's "Stenographers and Typists Manual", incorporating office procedures, was issued. Four main sections covering guides for communications, types of communications, mailing instructions and messenger service are supplemented by special instructions for individual units and three appendices. Each main section in turn is broken down and indexed. In clear, step-by-step instruction, augmented by examples, correspondence practice and office procedure are thoroughly spelled out.

This project completed, the committee realized it could function responsibly on a continuing basis, and a set of guidelines was drawn up. In addition to maintaining the manual's efficiency through up-to-date revision, the group could profitably serve in reviewing additions and changes with division management, and also in cooperating with the training section to determine clerical development and training needs. The training section likewise provides source material and assists in manual evaluation.

Task Force Appointed

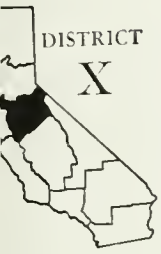
In order to function as an organized group, a chairman and cochairman were provided for (six-months terms); and a three-member task force assumes other duties and special assignments. The Management Analysis section affords advice and consultation to the committee on proposed manual changes involving policy, procedure and similar matters, and serves as a clearinghouse for changes.

As an example of current concerns of the Headquarters Correspondence Practices Committee, they have assisted Management Analysis in devising the proposed new district route tags, and in revision of the headquarters office route tag. As practices or procedures warrant attention, the committee schedules them for a future meeting and invites a representative from the department most directly concerned.

Merced Freeway

New Nine-Mile Section On Route 99 Completed

By DONALD D. HARNEY, Resident Engineer



In June 1964, the last of two contracts was completed and Sign Route 99 was converted to a full freeway from Gerard Avenue south of the City of Merced to Buhach d north of the City of Merced. s nine-mile section of new freeway nects with the three-mile Atwater ass which was completed in 1957, providing the motorists with a l of 12 miles of freeway in Merced nty. The completion of this sec- contract climaxed a construction od spanning nearly four years and ing $8,000,000.

July 1960, work began on the contract to provide for grading levated roadbed through the City Merced on new alignment between and 14th Streets. Drainage facil- and the construction of 15 bridges e also part of this contract.

Three million tons of material was required to construct the embankment for this four-lane roadbed. The material was trucked to the job site in bottom-dump trucks and trailers over state highways and city streets. Although temporary inconveniences were experienced by the local motorists and places of business, these were endured with a fine spirit of cooperation.

Full Interchanges

The first phase of this project also included the construction of two overcrossings above the Southern Pacific Railroad Company tracks, one at the south and one at the north end of the city. Full interchanges were constructed at the junctions of Sign Routes 140 and 59, and also "R" and "V" Streets in the City of Merced.

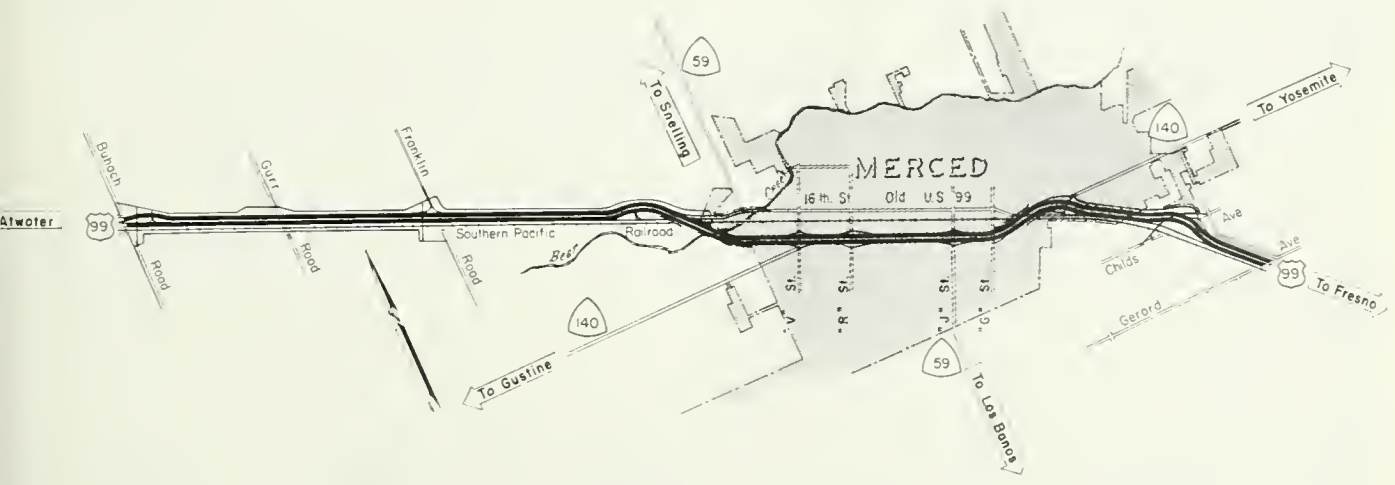
Undercrossings to accommodate the city traffic were built at 15th, "G", "L", "M" and "O" Streets. Eighteen thousand cubic yards of structure concrete was required for the bridge work on this phase, which was completed during April of 1962.

In October 1962, work began on the second contract which consisted of placing the base and paving on the previously completed embankment, construction of seven more bridges, and approximately seven miles of frontage roads.

System of Detours

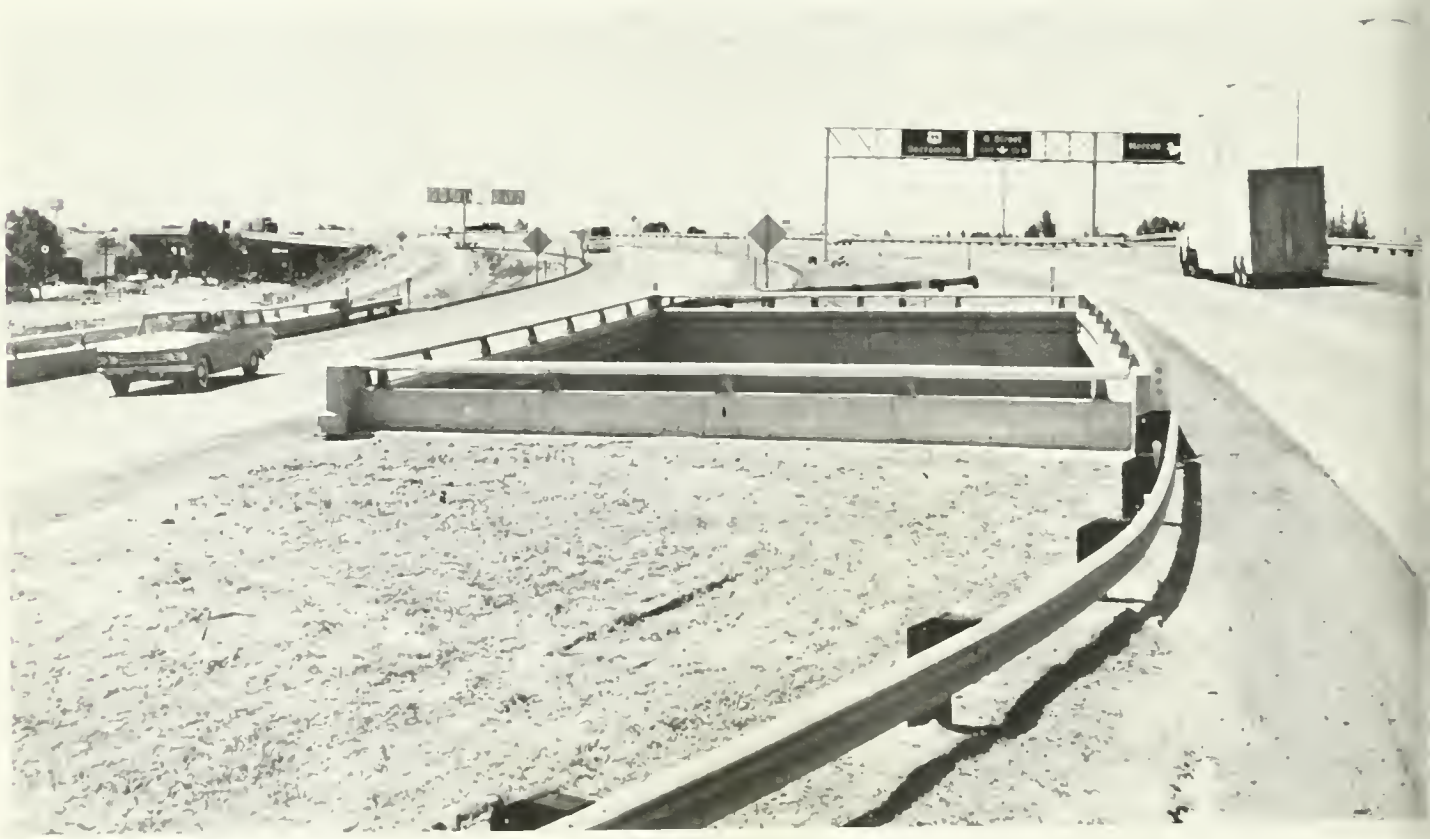
In order to handle traffic during construction, an intricate system of detours involving four stages had been worked out by the design engineers. As a result, the through traffic was carried around the work with a minimum of inconvenience.

In placing 35,000 cubic yards of portland cement concrete pavement for this project, the contractor used the central mix method and hauled mixed concrete in dump trucks. Although this method had previously been used in other parts of the State, this was the first time that it had been used in this area and it generated considerable local interest.



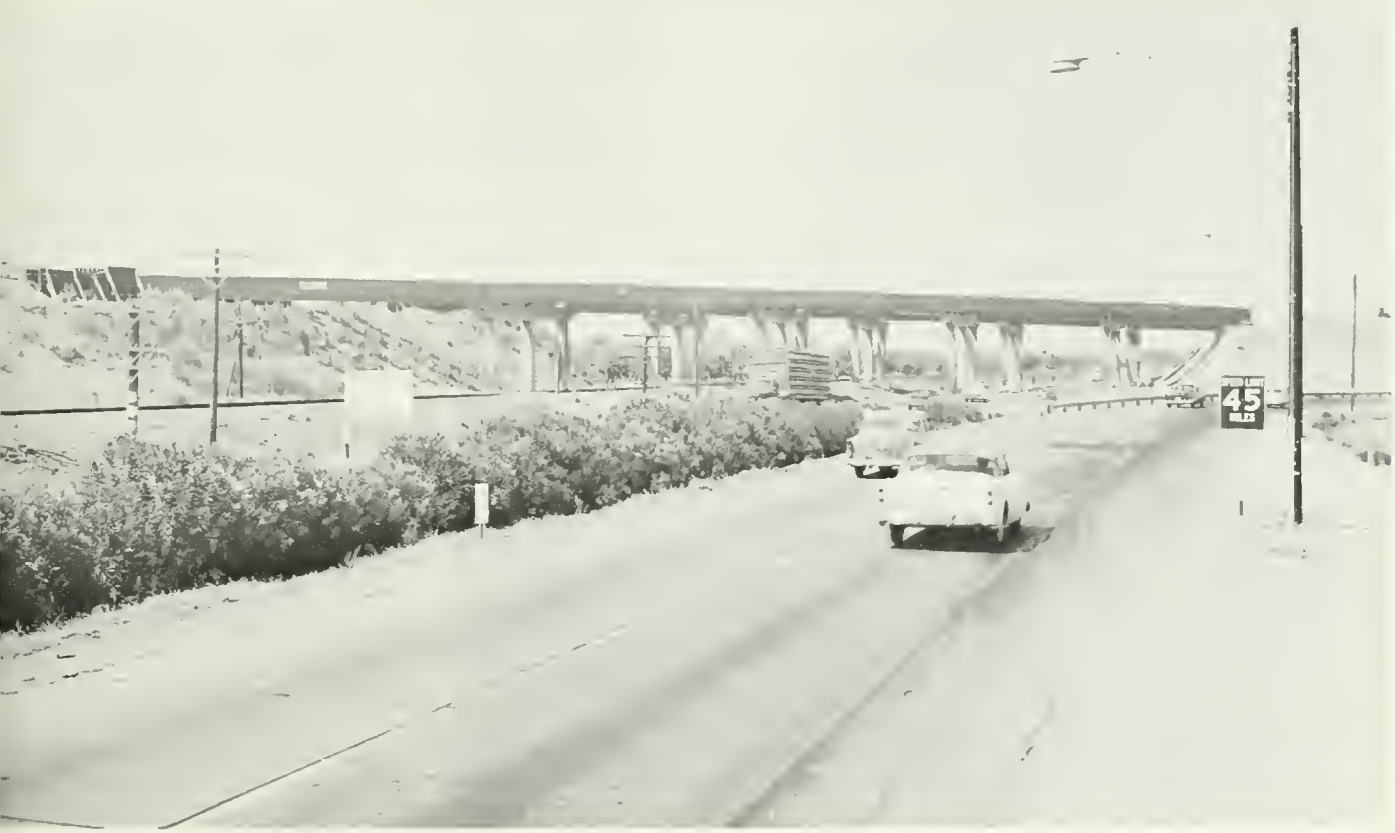
A map of the Merced area showing the location of the new nine-mile freeway section on Highway 99.

A view of the freeway at the Sign Route 140 ("V" Street) interchange.



The new freeway in the vicinity of the Sign Route 140 interchange showing the Merced off-ramp at upper right.

The new Highway 99-Sign Route 59 ("J" Street) separation in Merced.



West Merced overcrossing under construction. Highway 99 northbound traffic was detoured around the construction on the recently completed frontage road.

BEFORE. A view of the freeway through Merced when still under construction.

AFTER. The same view as above after the freeway through Merced was completed.

By October 1963, the main segment of the project through the city was ready for traffic. Through the efforts of Merced city officials, the Merced Chamber of Commerce and the contractor, a ribbon-cutting ceremony was held. Mr. Russell J. Cooney, Deputy Director of Public Works and former City Manager of Merced, was the principal speaker. Traffic was then diverted from 16th Street (old US 99) to the new freeway. The opening of this section relieved a highly-congested traffic situation and eliminated several traffic signals along the important north-south artery.

Highway Connections

Between October, 1963, and the completion of the project in June, 1964, the connections to the old US 99 highway were completed at the north and south ends of the freeway; a new bridge was constructed over Black Rascal Creek to handle the southbound traffic; and the interchange at Childs Avenue was completed.

During the period of construction of this project, the contractors and state forces received the finest cooperation from city and county officials and the residents of Merced. The Merced *Sun-Star* periodically printed articles dealing with the progress of the project and was most cooperative about giving publicity to changes in traffic patterns and detours.

Personnel

Key personnel included G. A. Brown, Superintendent for Fredrickson and Watson Construction Co., Lew Jones Construction Co. and Sierra Construction Co. who were awarded the first contract of $5 million as a joint venture. R. E. Wright and George Thompson were Bridge Department representatives for the State on the first phase. James Kovack was Superintendent for Peter Kiewit Company, the contractor for the second contract of $3 million. Ken Hironaka was Bridge Department representative and the author was the Resident Engineer for the entire construction project.

Living and Travel Patterns In Auto-Oriented Cities

By KARL MOSKOWITZ, Assistant Traffic Engineer

tor's Note: This poper was originally nted in Detroit in October, 1962, at ional symposium on "The Dynamics ban Transportotion" sponsored by Automobile Manufocturers Associa- It has since received increasing na- attention.

I.

o not know when or where the ssion "auto-oriented" originated; t became aware of it when the Council officially declared Sacra- o to be "auto-oriented."

cramento is the central city of a census urbanized area which had ulation of 451,920, in 1960—192,- n the city and 260,000 outside. e outside, about seven airline from downtown.

m a resident of this auto-oriented nunity and a civil engineer. Plain ents are not as different from engineers as is sometimes sup- l. Engineers employ many ways arching for the truth. These in- collecting, sifting, and analyzing discovering relationships, and cting these relationships. They de rational deduction based on aws of nature, calculating solu- to equations, inventing, building, testing. But the first thing an neer does, if he can, is to take a at what he can see with his own With this in mind, the first ter in this essay is going to be the rting of things I have seen and rienced myself.

ot only do I live in an officially -oriented community, but since ing to write this essay, I have e to the conclusion that I am -oriented myself.

Family Had No Car

was not always that way. Until as 11 years old (in 1921) there not even a car in my family. In we moved to San Francisco from Berkeley, a suburb about 10 miles away, because my father got a job in western San Francisco; and by the then-existing mass transportation, he could come home only on weekends. Later, he got a job in downtown San Francisco, and we moved back to Berkeley.

My father used to commute on the big red trains and white ferryboats of the Southern Pacific Company. The commute books contained tickets for every day in the month. This meant that on Sunday there was an unused commute ticket unless my brother or I used it to go to the city. As a result, I got a lot of rides on those trains and ferryboats, and I loved it.

I can still smell the wax and fresh paint of the upper deck (and the linoleum of the steamer "Berkeley") and the steam and cylinder oil and salt spray of the lower deck. I can still see the big connecting rods and crankshaft of the side-wheel paddles and the walking-beam above of the steamers Santa Clara, Alameda, and Oakland (the Berkeley did not have a walking beam). I can hear the creak of the piling when the boat hit the slip. I can smell the popcorn roasting in the ferry building. I can feel the slick varnished benches on the seat of my pants. It was a wonderful life, and a wonderful way of starting out the day. I was 12 years old at the time.

Train No Longer Glamorous

Ten years ago I took some rides on the Illinois Central between Chicago and the south side, and last year I took some rides on the subway in New York and on the combination subway-elevated in Philadelphia. In Philadelphia there is a station downtown, underneath the hotel where we stayed, which was reminiscent of the Ferry Building in San Francisco 40 years ago. For some reason it didn't seem as glamorous at age 51 as it did at age 12.

At the present time, I consider myself auto-oriented because there are two cars in my family of two people. I have a 10-year-old car which I drive 4,000 miles a year to and from work, and my wife has a four-year-old car which she runs errands in and that we use when we go out-of-town. Every time either of us goes any place, we go by car.

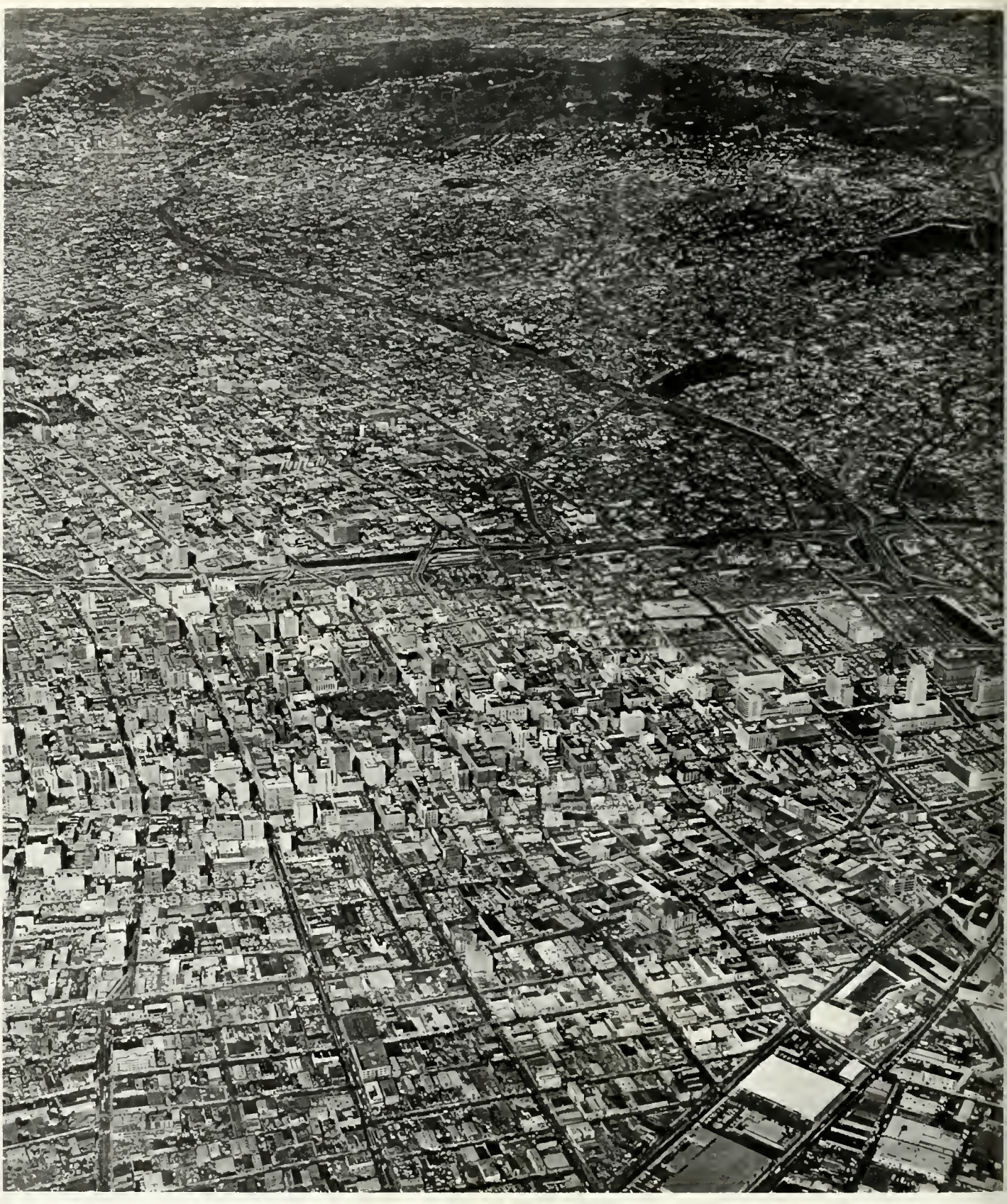
I live in the suburbs, 8.8 miles from where I work. It costs me $317 a year, or $26.50 per month to commute.*

I set my own time for going and coming. I have a comfortable seat and privacy. I keep dry in rainy weather, and it takes 24 minutes from my door to the door of the office building where I work. When the freeway, which is now underway, is completed, it will only take 18 minutes. It takes up to five minutes to get from the ground floor to the fifth floor of the building by mass transportation (elevators), including the wait.

Could Join Car Pool

If I cared to give up the flexibility of schedule and about 5 more minutes, I could join with two fellow-workers, ride in a newer car, and cut my costs by about two-thirds. As a matter of fact, for six years I did ride in a pool of five, and my cost then was $75 per year. A fellow across the street who works in the same building that I do *does* ride in a pool of five, each of whom takes the family car once a week. This does not cause him to buy any more cars than he would if he went to work on the train, if there were a train. So his total cost per

* Car Depreciation $50
Insurance 58
Garage Rent 78
Gasoline 54
Lube, tires, and repairs 37
Road taxes 40
$317



"In order to provide for between 50 percent and 60 percent of all the travel in an auto-oriented community, about 1.6 to 2 percent of the area should be devoted to freeways. The other 40 to 50 percent of the travel will take place on conventional roads and streets, which occupy about 22 percent of the total urban area." This aerial view looks from downtown Los Angeles toward Hollywood and the San Fernando Valley and shows the Harbor and Hollywood Freeways, with the four-level interchange at right center.

week is 40 cents for a downtown parking space and 97 cents for running expense of his car.

From the window of the room in my home where I am writing this, I can see the homes of five other neighbors, besides the one who works where I do.

One of these neighbors is a brake lining salesman, and his office is a den in his own house. Every time he leaves the house, he goes to a different place; and he puts about 50,000 miles a year on his car.

Second is a lumber dealer, whose yard is about four miles west of here.

Third is a house builder who is presently working on a house three miles north and one mile east of here. Next month he may be working on a house six miles south.

Fourth is a civilian employee of military establishment four miles north.

Fifth is a salesman in a hardware store two miles northwest.

Where Could Railroad Go?

As a civil engineer who majored in railroad engineering, I have been trying to figure out where I would lay a railroad that all of us could ride, if we were unhappy about driving. I must confess that my training is inadequate to this task. There is a freeway about four miles from where we live that does not quite go downtown yet. This freeway is paralleled by a railroad that does go downtown and is in a high-speed exclusive right-of-way. The railroad goes to the same places that the freeway goes, including the lumber yard and the military base. All of us use the freeway from time to time; three of us use it daily, but none of us uses the railroad. We wouldn't use it even if there were some trains on it, and the reason why is that we don't want to live on the railroad, although four of us do work near it.

All of us go to work by car, at the time we want to go and in the direction we want to go, and the longest it takes any of us is 24 minutes. About the longest trip a person can take in this auto-oriented urban area of a half-million people is one half hour, from edge to edge of the area.

Many persons who are devoting consideration to urban problems seem to encounter a paradox when they contemplate neighborhoods like the one I live in. This school of thought has been epitomized in the following quotation:

> "To most individuals, the automobile is a superior means of transportation. It is convenient, it is flexible, it takes them where they want to go.
>
> "From the social viewpoint, on the other hand, transit is the preferred form." [1]

My neighbors and I would agree with the part of this quotation regarding the automobile. But why is it necessary to say that the social viewpoint is "on the other hand"? An engineer would tabulate the alternatives as follows:

On the one hand	*On the other hand*
Automobile	Transit
To most individuals	Social viewpoint
Superior means of transportation	?
Convenient	?
Flexible	?
Takes them where they want to go	?

It is not very difficult to fill in the alternatives where the question marks appear. Inferior, inconvenient, inflexible, does not take most individuals where they want to go. The difficult thing to understand is the alternative that *is* filled in: Is "social viewpoint" on the other hand from "to most individuals"? Unless social is spelled with a capital S, as in "Social Notes From Newport and Park Avenue" (where transit may be preferred—for the masses), or as in "U.S.S.R." (where transit is also preferred, for reasons of their own), the social viewpoint must be considered equivalent, not opposite, to the viewpoint of most individuals—the individuals to whom the automobile is superior; convenient, flexible, taking them where they want to go, when they want to go, comfortably and in privacy.

Concern About Costs

The same school of thought that places the welfare of society on the opposite side from that of most individuals also seems to be very concerned about transportation costs, especially the fact that some of the costs may be "hidden". In this respect, I will guarantee that my six neighbors and I, who from time to time discuss automobile prices, tire prices, gas prices, insurance premiums, and parking fees over the back fence, know a lot more about the cost of driving a car than we do about the cost of running a railroad which some people would ask us to finance. From what we hear, the cost of running a commuter railroad is pretty high, and almost always necessitates getting money from people who don't use the railroad. It would not surprise me if we know more about the cost of driving a car than even the officials who run railroads and set fares know about the cost of transporting commuters, especially on a railroad that doesn't exist at the present time and would have to compete with an existing mass transportation system (highways) that suits most individuals pretty well.

While on the subject of travel performed by my six neighbors and me, I would like to discuss a frequently deplored fact that on the average, an automobile only carries 1.4 to 2.0 persons.

Passengers Per Car

One neighbor rides in a pool of five, and I drive by myself to the office. The average, so far, is 3.0 per car. The man who works at the military base takes a passenger. Now we have eight in three cars, or 2.67 per car. The lumber dealer, the brake salesman, and the builder drive their own cars, solo. Now we have 11 in 6 cars, or 1.83 average. Finally, the hardware salesman's wife drives him to work and returns by herself. To the observer making an occupancy study, this looks like one trip with two persons and one trip with one person, so we now have a total of 14 persons in 8 cars, or 1.75 per car. Actually, however, the last two car trips only accomplished one work trip, so the real average is 12 work trips in 8 cars of 1.5.

We go in six different directions at seven different times, and to me it

[1] Lyle C. Fitch, "A Transit Paradox." *National Civic Review*, April, 1962.

"The automobile that makes it possible for the housewife to hop in the car and drive a mile or two to a supermarket, instead of trudging a couple of blocks to the corner grocery, also makes it possible to live on long blocks which cut down the number and area of streets." (Aerial view of suburban freeway near Sacramento in the general area of the author's home.)

seems inevitable, not deplorable, that the average occupancy is low. If it is deplorable, about the only solution I can think of is to follow the example of the residents of an island where I spent some time during the war. Each family had four coconut trees and some grass and chickens and a pig, and they made their own soap and used coconut oil for cooking and lamp fuel, and nobody had to go any place.

What *would* be deplorable would be for all of us to be coerced by economic sanction or forced by fiat to live in places decreed by governmental authority, or to work in another place, decreed by the same authority.

Advantages of Location

One of the reasons why my neighbors and I live where we do is that for a given amount of housing money, we have more room. We consider this desirable. I have 7,000 square feet of grass, 50 shrubs, 5 trees, and 1,000 square feet of flower beds on my own lot, and I enjoy them. I may change 2,000 square feet of grass into a swimming pool next spring, but it will still look attractive and will be used and enjoyed.

My neighbors and I think it would be unfortunate if plans were to materialize that would make is impracticable to live the way we do. One such plan might be to make the cost of parking so high, by condemning the now privately owned land on which we park our cars for public purposes

we could not enjoy it and would
e to move.

Another plan might be to use the
0 per year I pay in road-user taxes
inance the deficit of a single-track
road which would not come to my
ghborhood. It is rumored that this
ginary single-track railroad would
able to carry 40,000 people in one
r. I cannot imagine where these
00 people would come from or go
or what this railroad would be
d for during the rest of the day,
I do know that I would not be
of the 40,000.

also know that my travel time is
now than it was 10 years ago,
pite the fact that this area has two
quarter times as many people now
t did then, and the reason for this is
t my user taxes have financed high-
improvements. It seems pretty
ious to me that if my highway
es were used to finance someone
's train ride, these improvements
uld come to a grinding halt, and
t I could look for steadily increas-
travel time in the future instead
the steadily decreasing time which
l really be achieved because the im-
vements will continue to be made.

II.

How can an auto-oriented urban
a solve its transportation problems
l provide for future growth?

have taken an approach to this
stion which is different from many
er attempts in one main way:

Instead of trying to decide what
will happen when a given city
grows, why not take a look at the
cities that have already grown?

would now like to call the reader's
ention to Table 1: "Population,
ea, and Miles of Freeway—Five
ban Areas in California".

The five urban areas shown in the
le were chosen at random, to cover
vide range in population. Freeway
nning in these cities has progressed
enough to know just how many
eways are needed, and, as a matter
fact, where they will be located
thin a small range of adjustment. In
ner words, Table 1 is based on facts,
t conjecture.

In 1959 the California State Legisla-
re enacted a far-reaching law (Sen-

TABLE 1

POPULATION, AREA, AND MILES OF FREEWAY FIVE URBAN AREAS IN CALIFORNIA

	Santa Rosa	*Fresno*	*Sacramento*	*San Diego*	*Los Angeles*
1. Population, 1960	38,800	213,400	438,127	836,200	6,488,000
2. Area, square miles *	13	70	147	263	1,520
3. Population per square mile	2,980	3,050	2,980	3,180	4,260
4. Miles of freeways in operation or budgeted (1962)	4.5	9.1	28.8	38.9	242
5. Miles of freeways needed for 1960 population	5.5	23.5	56.9	99.0	515
6. Freeway miles per square mile	0.42	0.34	0.38	0.38	0.34
7. Per 10,000 population	1.4	1.1	1.3	1.2	0.8
8. Proportion of area occupied by freeways	0.020	0.016	0.018	0.018	0.016

* These areas are slightly different from Census Bureau areas. Census Bureau areas apparently exclude enclaves. For the purpose of relating road miles to area, the overall area must be considered.

ate Bill 480, introduced by Senator Randolph Collier) that established a 12,000-mile freeway system in the State of California. Maps have been drawn which show the freeways that will be required and constructed in all the urban areas in the State by 1980.

No Crystal Ball Needed

All I had to do in order to construct Table 1 was to look at these maps and decide from knowledge of the present status of these five communities how many of these freeways are needed now (1962). There is no crystal-ball gazing involved. I measured the miles and put them down in the table. The miles shown on line 5 would enable residents in all parts of each community to enjoy journey times as portrayed by curve A on Figure 1. (At the present status of construction shown on line 4 of Table 1, some residents but not all get freeway rides; and the typical journey time in most California communities lies somewhere between curves A and B.)

One thing that the reader will note as he studies Table 1 is the amazing consistency between communities having such a wide spread in size. Professor Edgar M. Horwood of the University of Washington tried a similar analysis on a national scale and found almost no consistency. I think maybe there are two reasons for this. First, California has been auto-oriented for quite a while and experience helps; second, he was looking at *future* plans, whereas I am looking at *present* plans.

There has been a lot of loose talk and writing about the area consumed by freeways, streets, and parking. The facts as shown in Table 1 are different from much of this talk. In order to provide for between 50 percent and 60 percent of all the travel in an auto-oriented community, about 1.6 percent to 2 percent of the area should be devoted to freeways. The other 40 percent to 50 percent of the travel will take place on conventional roads and streets, which occupy about 22 percent of the total urban area. This travel will mostly be short trips and really can be looked upon as land-access travel. No trip can begin or end on a freeway.

Surprising Fact

In the course of investigating areas devoted to travel, I came across a fact which really surprised me, and I imagine will come as quite a shock to some people who have been concerned about land areas consumed for transportation purposes.

In Part I of this essay, I mentioned that I had not always been auto-oriented. The same thing applies to the City of Sacramento. In 1850 Captain John Sutter laid out the City of Sacramento. He could not have been auto-oriented. He was horse- and pedestrian-oriented. He set aside not 1.6 percent, not 15 percent, not 22, but *38* percent of the area for streets and sidewalks.

The parts of Sacramento that were laid out in the 1900-1930 era have about 21 percent of the area in streets, and the parts that have been laid out since World War II have about 15 percent. The overall average in the city limits is 22 percent.

This reduction as the auto came into prominence is not a coincidence. In the days when people had to walk, there had to be a lot of streets because they couldn't walk around the ¼ to ½-mile-long blocks that are suited so well to the automobile age. The automobile that makes it possible for the housewife to hop in the car and drive a mile or two to a supermarket instead of trudging a couple of blocks to the corner grocery, also makes it possible to live on long blocks which cut down the number and area of streets. When the auto-oriented housewife wants to exercise, she again gets in the car and drives to the golf course.

The 18 percent or more of the total area which is thus *saved* by auto transportation will cover the area required for freeways *tenfold*.

Population Will Double

Most California communities anticipate doubling in size during the next 20 years. I do not know whether this will happen or not. During the past 100 years, California has a little more than doubled every 20 years. It is getting to be a habit, and a way of thinking, and people would be surprised if it didn't keep on being that way.

This growth, if it takes place, will create travel. The 1.6 percent of the urban areas, and approximately 0.2 percent of the rural areas that will be occupied by the 12,000-mile freeway system will take care of an amount of travel, in vehicle-miles, equal to the total amount of travel that will be added.

Instead of wringing their hands about this travel, Californians are preparing for it. We do not foresee being "choked" by transportation problems.

Another frequently heard comment based on imagination instead of fact, is that parking takes too much space. The facts are that one car space in an off-street parking facility takes about 340 square feet, including aisles and leftovers. A parallel-parking stall on a street occupies 176 square feet. (This does no mean, to me at least, that on-street parking is desirable.) At 340 square feet apiece, one square mile will provide surface parking for 82,000 cars. To park all of the 3.3 million cars in the Los Angeles urban area simultaneously, off-street at a place other than their home base on one level (as opposed to multilevel parking garages), would require 40 square miles, or 2.6 percent of the urban area. In Sacramento, which is more typical of communities between 20,000 and 1,000,000 population, all 225,000 cars could be parked simultaneously away from home, off-street on one level in 2.7 square miles or 1.8 percent of the area.

Area For Parked Cars

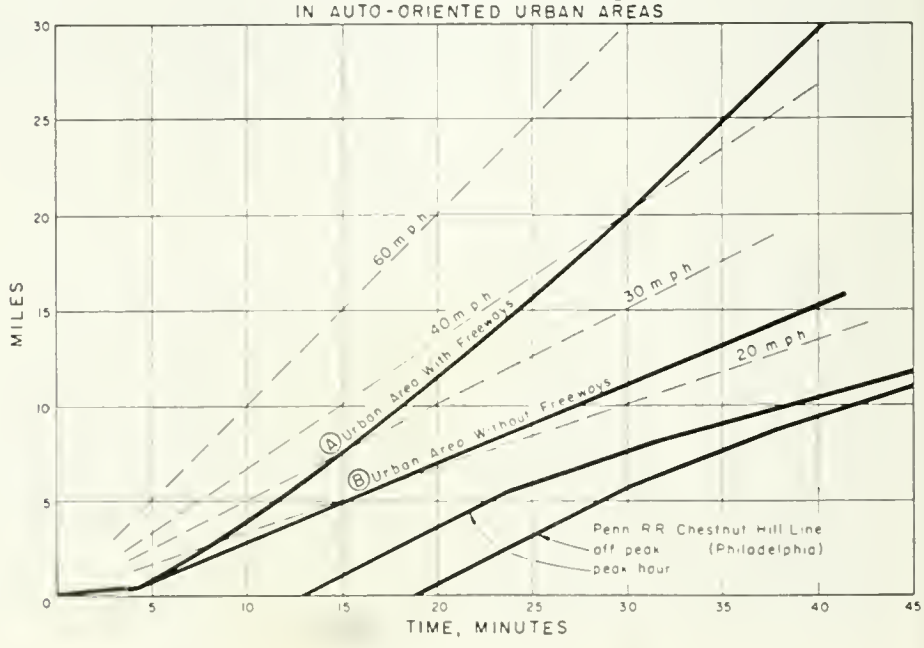
However, all cars are not away from home at any one instant. In fact, less than half of them are, and many of these are on the streets and highways. Also, there are many multilevel facilities. So the actual area devoted to parked cars is more like 0.4 percent to 1.0 percent. I do not think this will break a community. In fact, judging by the financial and any other index that can be thought of, it seems as though the communities that do have lots of cars and lots of freeways and lots of parking space are doing much better than the ones that don't.

The heart of the matter of areas consumed is this: If you look at an office building you might see an area with 0 percent parking. If you look at a shopping center, you note a large amount of parking area in one place. If you look at a downtown area, you note parking areas in many places. If you look at a garage, it is 100 percent devoted to parking. This is neither good nor bad. It is simply necessary in order to do business. The question is, where do you draw the boundaries of the "area"? In an auto-oriented community, the boundaries are sufficient to encompass the places where the citizens live and work and play. The total area is devoted to all kinds of activities, one of which is parking cars. From the perspective of total community resources, it is the ½ percent to 1 percent of the total area devoted to parking that should be looked at.

Statistical Aspects

To round out the statistical aspects of travel in an auto-oriented community, I have prepared Figure 1 showing

FIGURE 1
TYPICAL JOURNEY TIMES
IN AUTO-ORIENTED URBAN AREAS



typical journey times for various lengths of trip.

This chart is pretty much self-explanatory. Among other things, it shows why freeways become more important as the community grows larger. Attention is invited to the fact that a 30-minute journey only goes about half as far in a community without freeways as in a community with freeways. This means that for the same travel time, the freeway community can have four times as much area and four times the population.

In order to aid readers who may not live in auto-oriented communities to interpret the chart, I have plotted the journey time and distance along the Chestnut Hill line of the Pennsylvania Railroad on this same chart. This information came from a timetable I picked up in Philadelphia last year (1961). I assumed that the typical passenger lives within five minutes from the station. No allowance was made for his wife's time if she drives down to the station to pick him up. The peak hour journey time is less than the off-peak because the average waiting time for the train to start is only 8 minutes during the peak as opposed to 14 minutes during the off-peak.

The comparison also may be of interest to readers who live in auto-oriented communities that are contemplating large investments in commuter railroads, but before drawing any conclusions from it, they should realize that most of them will live more than five minutes away from the station, and they will also work more than five minutes from the station.

Is it good or bad for an urban area to be spread out, as automobile oriented cities are? [2]

In 1962, when I first prepared this paper, I made some comparisons between Los Angeles (an automobile-oriented city) and New York City (a rail-transit-oriented city).

I noticed that there was a lot of traffic congestion in New York City, more in fact than in any other city in the United States; and furthermore, that the congestion there was comparable only to that in other world cities where extensive rail transit is available: Paris, London and Tokyo. The only large city where there is plenty of rail transit and no automobile traffic congestion is Moscow, and I don't believe that the absence of automobile traffic there is attributable to the presence of subways.

I noticed that prices were high in New York. I noticed that there are lots of offices in New York, and I think that they rent for a lot more money than comparable offices in Los Angeles, and I don't think you can get more work done in them. I think that the prices are related to the rent, and I think that the rent is related to the scarcity of land, and I think that the auto-oriented mobility of Los Angeles makes it impossible for land to get as scarce there as it is in New York, especially on Manhattan Island.

Harmer Davis puts it this way: [3]

"If transportation were costless, instantaneous, and everywhere available, we would postulate that the choice of location of activities could be made on a basis other than the fact or act of transport. There would then be no need to concentrate activities merely to avoid transportation costs.

"While the facts of nature and life as we know them preclude achieving this ideal state of effortless transport, there is nevertheless some value in speculating about the implications of having less costly, speedier and more universally available transport than was available at some previous time. An important implication is this: as the availability of transport is increased and its cost decreased, not only are the limitations on the spatial organization of activities in our urban regions relaxed to some degree, but to some degree possibilities are opened up for greater emphasis on locational criteria other than transportation.

"Although the cost of providing transport to support the functioning of our urban regions is still not inconsiderable, no part of these regions now lacks access in some degree. This means that we can begin thinking more about what is optimal organization of urban functions. It means that we no longer are compelled to concentrate all urban activities except housing in a central congested core in order to obtain the economies of joint use, as conditioned by scarce and costly transportation. If we now choose to concentrate selected functions in a small central core, perhaps we should begin to try to analyze what is the optimal concentration. By the same token, we should more seriously begin to inquire into what is optimal dispersion, and what is a suitable pattern for a dispersed arrangement.

"Once a region attains a sufficient variety and ubiquity of transport throughout, and a range of activities has been located without being unduly inhibited by lack of transport, we might expect that the installation of a particular new transport facility would no longer, of itself, be a dominant factor in inducing new speculative activity in a particular sector of the region: nor would some added transport service necessarily of itself be a guarantee of preserving to some sector activities which it formerly had by virtue of scarce regional transport."

A lot of people have noticed the advantages of living in Los Angeles. Between 1950 and 1960, the population in the urban area of Los Angeles increased by 2.5 million people, from 4.0 to 6.5 million. This makes it the second largest urban area in the country, exceeding the Chicago-Northwestern Indiana urban area by more than one-half million. The 10-year growth alone was more than the total population of all but four of the other urban areas in the U. S. This does not sound like an ailing community. It sounds instead like a thriving community and I think it is because of, not in spite of, the automobiles there.

Los Angeles Urban Area

There are 3.3 million automobiles in the Los Angeles urban area and more than 200 miles of freeways. The autos and trucks travel about six billion miles yearly on the freeways, and another 18 billion miles on the rest of the streets and highways. About six billion passenger movements per year are now being made by automobiles in the Los Angeles area. To appreciate the magnitude of this number, it may be compared with the 1.7 billion passengers that used the subways and buses in New York in 1959. The Los Angeles Freeways are one of the largest *and fastest* mass transportation systems in the world.

In spite of the congestion that takes place at some locations, the journey

[2] Editor's note: Portions of the following were inserted by the author in July, 1964.

[3] "Some Aspects of the Interrelationship of Transportation and Land Use" by Harmer E. Davis, Director, Institute of Transportation and Traffic Engineering, University of California. (Prepared for an ASCE Conference at Salt Lake City, May 13, 1964.)

time between typical locations in the metropolitan area of Los Angeles is less now than it was 25 years ago (and in fact less than it ever was), notwithstanding that the *increase* in population during that time has been greater than the *total* population of the Philadelphia-New Jersey urban area is now. Travel time is becoming less every year. Between 4:30 and 6 p.m., a 60-mile ride through the whole area along the long axis, from Calabasas to Tustin, takes 90 minutes. During the off peak, it takes 70 minutes. A 45-minute band from 7th and Broadway in the peak hour encompasses 5.8 million people. During the off-peak, 30 minutes takes you clear out of the urbanized area (and on the east side into the next one).

Freeways Connect Areas

I am going to close this essay on living and traveling in auto-oriented cities with a quotation from *Life* magazine (June 20, 1960):

> "Los Angeles, seemingly boundless in size and energy, has taken on the one great attribute it has so far lacked—that of a cohesive city. The tremendous sprawl of Los Angeles across the arid hills and valleys gave it the reputation of being many suburbs in search of a city. The expansion continues. But more and more Los Angeles looks, acts, and sounds like a city.
>
> "Imaginative architecture, previously expressed in suburban markets and ranch homes, is forming the heart of downtown from decay into a smart unit of buildings. Home construction on hills closer to the city and the erection of towering apartments have helped consolidate the population. A growing civic pride helped build the $6 million Sports Arena where the Democratic Convention will be held next month. The roar of civic pride fills the Los Angeles Coliseum when the Dodgers play.
>
> "*More important than the Dodgers or civic buildings in giving Los Angeles its new personality are the ribbons of freeway which are gradually tying the city's scattered pieces together.*"

National Highway Week to Be Marked

Preparations for the fourth annual National Highway Week are going ahead in all parts of California, under the leadership of a statewide committee and numerous local committees.

The observance this year is scheduled for the week of October 4-10. In previous years it has taken place in the spring. This year also sees a new national sponsoring group—the American Association of State Highway Officials, with its member departments assisting with the programs in their respective states.

The California observance will be built to some extent around the 25th anniversary of the State's freeway law, which went into effect in September 1939.

The California National Highway Week Committee is headed by Harrison R. Baker of Pasadena, a former member of the California Highway Commission and a long-time leader in highway affairs.

The vice chairmen are two other former Highway Commission members: Judge John J. Purchio of Alameda County, and Robert E. McClure of Santa Monica.

The committee secretary is Richard K. Bowler, manager of the engineering department of the Automobile Club of Southern California.

More than 25 organizations, some of them statewide and some regional, are represented on the committee. They include auto clubs, governmental organizations, civic organizations, and transportation, construction, and safety organizations.

State Highway Engineer J. C. Womack has instructed the 11 district engineers of the Division of Highways to cooperate extensively with local committees in arranging appropriate events and displays. Ribbon-cutting ceremonies for newly completed highway projects are expected to occur in several locations during the week. Other features will include newspaper articles on regional highway progress, window displays, etc.

Bowers Is Cited as Shade Tree Pioneer

H. Dana Bowers, Supervising Landscape Architect for the California Division of Highways, has received the Award of Achievement of the Western Chapter of the International Shade Tree Conference.

The award is made to a person or firm who has, through specific projects or programs, contributed to the advancement and use of shade trees in the western area.

Presentation was made at the chapter's recent annual meeting in Seattle, Washington.

Bowers was honored by a standing ovation when the award was announced.

A pioneer in roadside development work, Bowers started selecting and developing vista points and fountains along the highways for the State of California in 1929. In 1935 he was placed in charge of the development of roadsides for the whole state highway system.

He has supervised the planting of trees, shrubs, flowers and vines along more than 1,000 miles of modern multi-lane freeways and expressways.

In the presentation of the award, Bowers was cited as one who has planted more ornamental trees and other plants over a greater area for the enjoyment and safety of more people than any other person in the West during his nearly four decades with the State of California. He has searched for and tried every known plant which might fit somewhere into the varied roadside conditions of his State.

Bowers' work also resulted in new standards for erosion control.

His findings have been used by landscape contractors, government agencies and individuals throughout the United States. Many engineers and students from overseas have come to study his methods and work.

Bowers is a charter member of the original Western Shade Tree Conference which he helped organize in 1934.

Staff Promotions

Hart Heads District IV; Warren, Estep Advanced

The appointment of Alan S. Hart, istrict engineer for the California ivision of Highways in the Sacra-ento-Marysville area for the past ven years, as the new district engi-eer for the San Francisco Bay area District IV) has been announced by tate Highway Engineer J. C. Wo-ack.

To succeed Hart as the district en-neer for District III, an 11-county ea with headquarters in Marysville, Womack appointed Willard L. War-n, who has been the division's engi-eer of design since 1960.

The new engineer of design is Al-ord C. Estep, who has been the vision's assistant office engineer in harge of industry contacts since 961 and before that was district de-gn engineer in the San Diego district.

WILLARD L. WARREN

Hart was promoted to the Bay area osition, which carries the civil serv-e ranking of metropolitan district ngineer, to succeed the late J. P. Sin-lair, who passed away last month as he result of a heart attack.

ALAN S. HART

District IV, with headquarters in San Francisco, includes nine counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Santa Cruz and Sonoma. Its highway budget for the current fiscal year amounts to more than $72,000,000 for construction and rights-of-way.

His new assignment will be Hart's fourth post as district engineer since 1950. In that year he was appointed to head the Bishop district, moving to the Eureka district in 1953 and to Marysville in 1957. He has been closely identified with planning the freeway network for the Sacramento area which is now in the construction stage.

A native of Santa Rosa, Hart was graduated from the University of California in 1930 in civil engineering and has been on the Division of Highways staff since then. His earliest assignments were in the Marysville district. He was promoted to district maintenance engineer at San Luis Obispo in 1945, and to assistant district engineer at Eureka in 1948.

In July, 1962, Hart was promoted "on the job" at Marysville to the civil service rating of assistant state highway engineer.

Hart is a member of the American Society of Civil Engineers and the American Society of Photogrammetry. His other affiliations include the Commonwealth Club of San Francisco, Rotary, Masons, Shrine and Elks.

He and Mrs. Hart have one son, Keith, who lives with his wife and two children in Milpitas.

Warren, the new district engineer of District III, is a native of Kentucky who grew up there and in Ohio, studied engineering at Sacramento City College and the University of California and began his professional career with the Nevada State Highway Department in 1936. During World War II he worked for the Army Corps of Engineers in Northern California and Utah.

ALVORD C. ESTEP

. . . Continued on page 56

STAFF PROMOTIONS (Cont.)

Joining the California Division of Highways in 1946, Warren served in the Marysville district in traffic engineering, design, construction and route location, and was transferred to division headquarters in Sacramento in 1950 as assistant engineer of design. He was promoted to engineer of design in 1960.

Warren is a member of the design committee of the American Association of State Highway Officials and is chairman of a design section of the Highway Research Board of the National Academy of Sciences.

A resident of West Sacramento, Yolo County, for the past 18 years, Warren has served as a member of the Board of Trustees of the Woodland High School District and is currently on the board of the West Sacramento Sanitary District, among other civic activities. He and his wife have two daughters, Mrs. Leonard Speth of Fresno, and Linda, a student at Fresno State College.

District III, which he will head, comprises the valley and mountain counties of Butte, El Dorado, Colusa, Glenn, Nevada, Placer, Sacramento, Sierra, Sutter, Yolo and Yuba. Its total budget for construction and rights of way this year amounts to nearly $60,000,000.

Estep, the new engineer of design, is a native of Cheraw, Colorado, who moved to San Diego in 1935, worked for various engineering firms, and was graduated from San Diego State College in 1943. After U.S. Navy service in World War II as an officer aboard the destroyer U.S.S. Beale, he joined the Division of Highways in San Diego as a field inspector on construction work, advanced to various other assignments, and served as resident engineer on major freeway construction in the San Diego area. He later worked in advance planning and then as district design engineer before his promotion to assistant office engineer in division headquarters in 1961.

Estep is a member of the American Society of Civil Engineers and the American Public Works Association. He and his wife have two sons, David and Douglas.

Right-of-way Posts For Kagan, Frankland

Appointment of Harry L. Kagan as an assistant chief right-of-way agent for the California Division of Highways has been announced.

Kagan, whose appointment was effective June 15, fills the vacancy created by the death of R. E. O'Bier, who headed the division's property acquisition program under the direction of Chief Right of Way Agent Rudolf Hess.

HARRY L. KAGAN

Stepping up to Kagan's former post as supervising right-of-way agent in charge of research and development is Bamford Frankland, who has been in charge of operational research.

In his new position, Kagan will supervise an activity which in the last fiscal year involved the acquisition for highway purposes of 8,131 parcels at a total expenditure of more than $145,000,000.

A native of San Francisco, he attended Washington High School and San Francisco State College before receiving his A.B. from the University of California in 1942. After four years as a line officer in the Navy, serving in the European and Pacific Theaters, he taught school briefly in San Francisco. In February, 1947, Kagan entered state service as a junior real property agent for the Division of Highways in San Francisco.

BAMFORD FRANKLAND

He advanced through positions of increasing responsibility in San Francisco until February, 1961, when he was appointed a supervising right-of-way agent and transferred to division headquarters in Sacramento.

One of his recent projects was the organization of the division's first right-of-way academy, which was conducted on the Davis campus of the University of California in 1963.

Kagan is a member of the American Right of Way Association. He is married and has a daughter.

Frankland, his successor, was born in Sacramento and attended Sacramento High School before going on to the University of California at Berkeley, where he received a bachelor's degree in 1950. He served in the U.S. Army for two years, and then joined the Division of Highways as a junior right-of-way agent in Marysville.

In January, 1960, he was transferred as an associate right-of-way agent to division headquarters in Sacramento, where he was in charge of land economic studies until recently. He is the author of several articles on the economic impact of freeways.

A member of the American Right of Way Association, Frankland is married and has two sons and a daughter.

Magazine Loses Associate Editor

John C. Robinson, Associate Editor of *California Highways and Public Works* for the past 4½ years has left the Division of Highways to become chief information officer for the State Department of Social Welfare.

Robinson came to work for Highways in 1957. A native of Farmingdale, New Jersey, he served in the U.S. Navy from 1928 to 1948.

He is co-author of the book "State Parks of California" published by *Sunset* Magazine in 1961.

His articles and photos have appeared in many magazines including *Sunset*, *Better Homes and Gardens*, *Family Circle*, *House Beautiful*, *House and Garden*, *This Week* and various newspaper supplements.

The second installment of this article "Redwood Highway" appears in this issue of the magazine. The third and final installment will appear in the next issue.

Route Adoptions

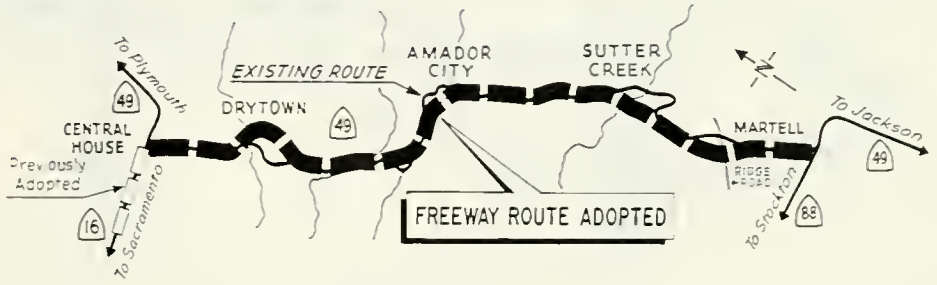
Commission Adopts 115 Miles of Freeway at May, June Meetings

The California Highway Commission adopted the locations for approximately 115 freeway miles on 15 routes at its May and June meetings. well as relocating or extending ore than 30 miles of five conventional highways.

Although all of the adoption actions ere preceded by public hearings conucted by the Division of Highways accordance with established proedures. the commission itself also eld public hearings prior to adopting ree freeway routes in Fresno. Sacmento and Amador counties.

The Fresno adoption was for 9.4 iles of State Sign Route 41 between M" Street in Fresno and one mile outh of the Madera county line. The outherly portion of the routing had een the subject of considerable local ontroversy.

In adopting the "C-B" alternate oute favored by the State Highway ngineer, the commission noted that he "C" portion south of McKinley venue will cost approximately $2,-50,000 less to construct than the equivalent "B" alternate. while providing $18.000.000 more in 20-year user benefits. Additionally. it was favored by local property owners.

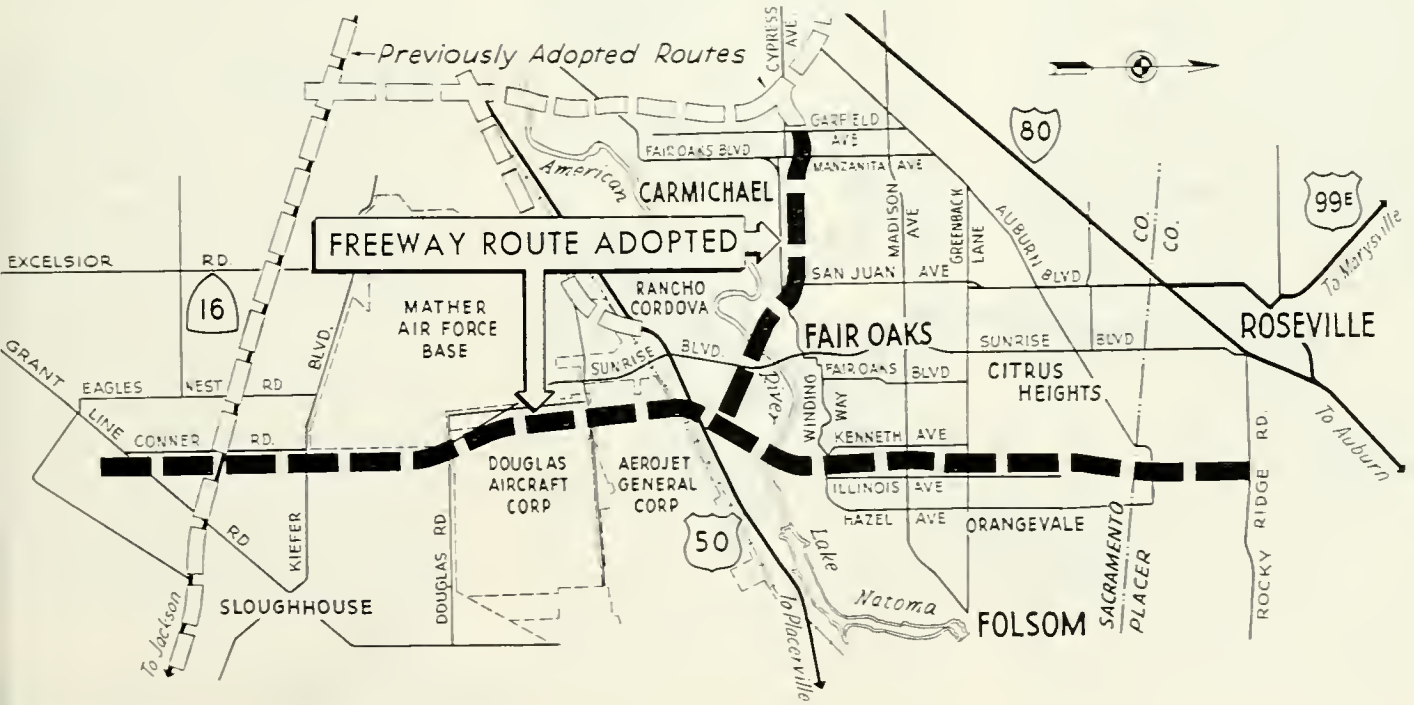


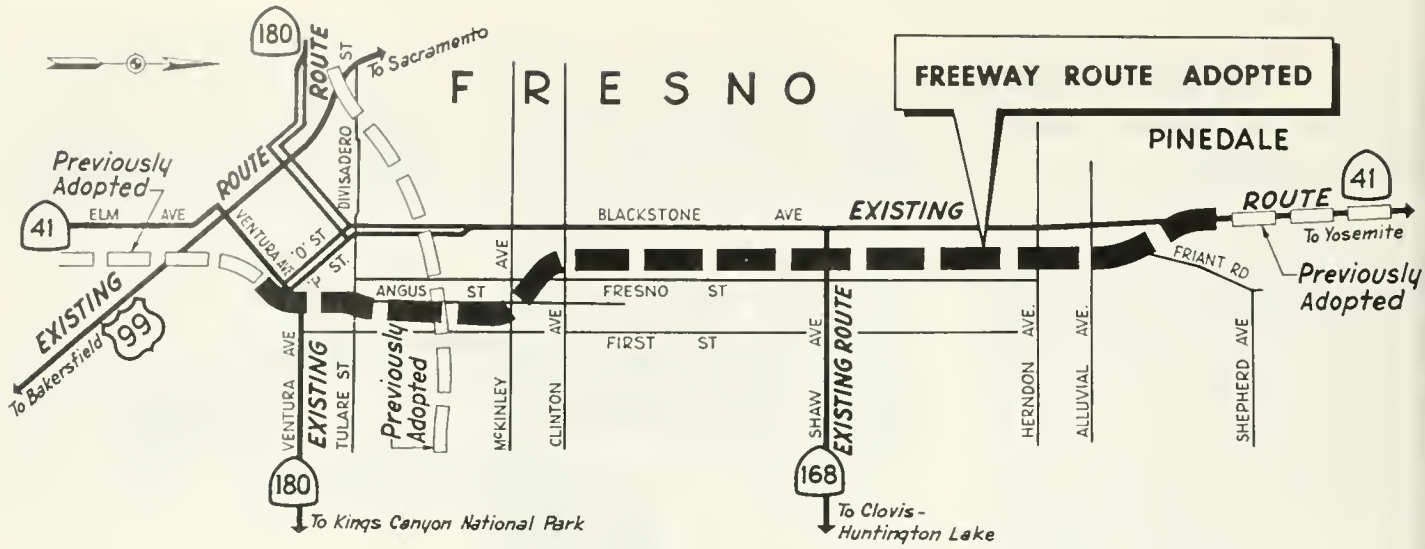
The commission found little disagreement concerning the "B" portion northerly from McKinley Avenue to the county boundary.

Sacramento County

The adopted route in Sacramento County. identified as the "A" line at the public hearing conducted by the commission in Folsom in April. extends 18.6 miles northerly on Route 65 from west of Sloughhouse in Sacramento County to east of Roseville in Placer County.

In its findings. the commission reported that the adopted route. conforming to the "major streets and highways" plan of the Sacramento County Board of Supervisors. the county's master plan for school sites of the San Juan Unified School District. and endorsed by the Roseville City Council and the Placer County Department of Public Works. would provide far greater traffic service than other alternates favored by the City of Folsom and a Fair Oaks civic group.

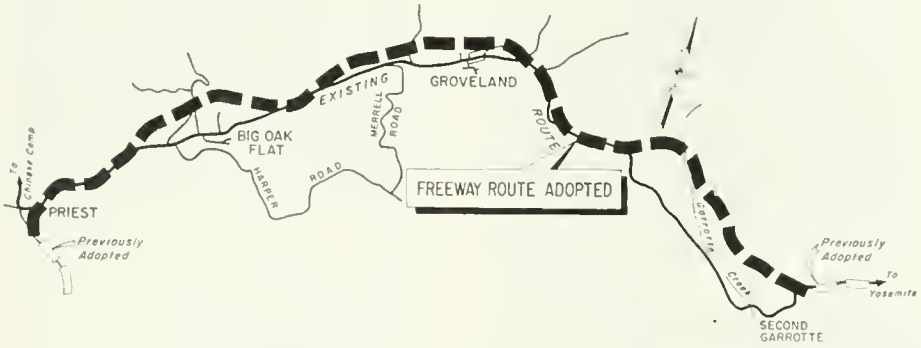


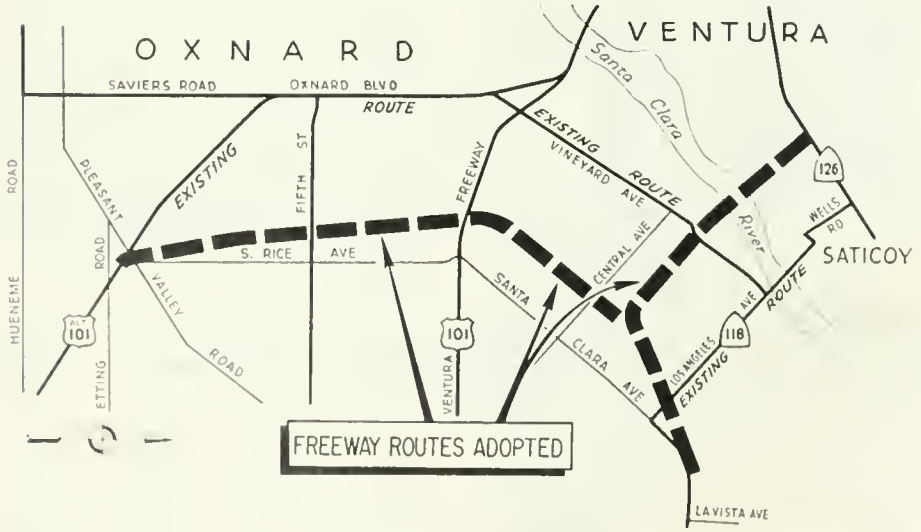


In Amador County, the commission adopted a freeway routing for 7.9 miles of State Sign Route 49, the "Mother Lode Highway," between State Sign Route 88 at Martell and State Sign Route 16 at Central House.

Built-up Sections Bypassed

The adopted routing generally follows the existing highway alignment but swings away from the built-up sections of Sutter Creek, Amador City and Drytown.





The commission said this routing will avoid disrupting historic sites and buildings, was least costly of the feasible alternates studied, and will provide the best service to local, tourist and through traffic.

Both the Sacramento and Amador County routings had been recommended by State Highway Engineer J. C. Womack.

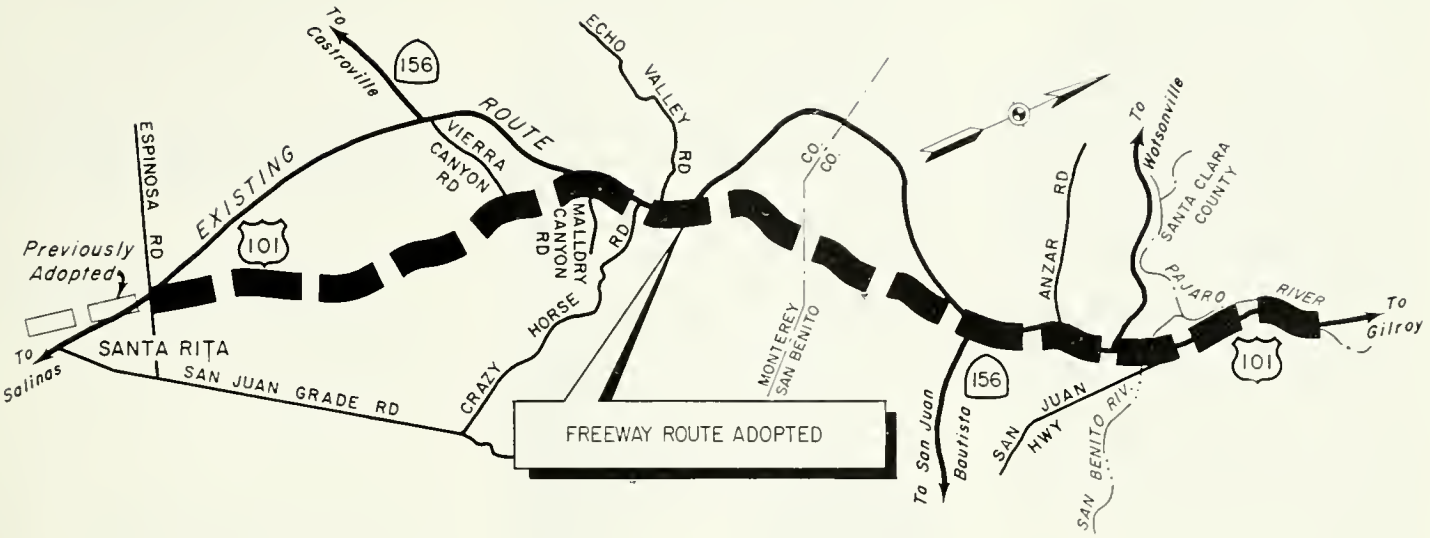
In other freeway adoption actions, the commission located routes as follows:

Monterey and San Benito Counties: 15.5 miles of U.S. 101 between Espinosa Road, near Santa Rita in Monterey County, and the San Benito-Santa Clara county line.

Riverside County: 10.1 miles of State Sign Route 74, the "Pines to Palms Highway," between the western boundary of the San Bernardino National Forest and Mountain Center.

Sacramento County: 5.5 miles of new Route 244 in the Fair Oaks-Carmichael area running easterly from a freeway routing adopted in 1961.

Sacramento and Placer Counties: 17 miles of new Route 65 (former U.S. 99E) northerly from Interstate 80 in Sacramento County through the Roseville-Lincoln area of Placer County, and two miles of new Route 193 (former Route 91) between the adopted section of Route 65 southwest of Lincoln and the existing highway near the Titan Missile site.



San Diego County: Five miles of State Sign Route 78 between US 395 in Escondido and the San Diego city limit west of Pasqual Road.

UC at Santa Barbara

Santa Barbara County: One mile of new Route 217 (former Route 236), extending the recently completed Ward Memorial Boulevard Highway along Goleta Slough to the main entrance of the University of California's Santa Barbara campus.

Santa Clara and Alameda Counties: 5.2 miles of State Sign Route 9 between the existing highway at Santa Clara-Alviso Road in Santa Clara County and the adopted route for the Sign Route 17 Freeway in Fremont, Alameda County.

Tuolumne County: 5.9 miles of State Sign Route 120 between Priest and three miles east of Groveland.

Ventura County: 21.4 miles of State Sign Route 126 between west of Orcutt Road, east of Santa Paula, and the Ventura-Los Angeles county line.

Ventura County: 11.2 miles of interconnecting freeway routings of new Route 1 (former US 101 Alternate), new Route 232 (former Route 154), and State Sign Route 118. The 4.1-mile Route 1 section runs from southeast of Oxnard to a new connection with the Ventura Freeway, connecting to the newly adopted 2.2-mile section of Route 232 which extends it northeastward to the newly adopted route for State Sign Route 118. The 4.9-mile routing for 118 runs between State Sign Route 126, northwest of Saticoy, and the adopted route for Route 232, then easterly to a junction with the existing highway west of La Vista Avenue.

Future Expansion Envisioned

The plans of the Division of Highways call for initial construction ranging from a two-lane, access controlled highway, with provision for expansion to four lanes if and when required, as in Amador County, to construction of an eight- and six-lane freeway, with provision for expansion to eight lanes throughout, as in the interconnected freeway routings in Ventura County.

The cost of these freeways is estimated at $239,340,000, including rights of way.

The Commission also adopted as conventional highways:

Kern County: A 9.4-mile new routing for Route 223 (former Route 140) between US 99 and Arvin, eliminating six right angle turns and lessening confusion for non-local motorists; and a two-mile extension of new Route 184 (former Route 143) to connect with the US 99-Arvin routing.

Lake County: A 5.9-mile section of new Route 175 (former Route 16), an important east-west lateral across the Mayacmas Mountains between US 101 and the Lake County resort areas, between one-half mile east of the Mendocino County line and west of the junction with State Sign Route 29.

Siskiyou County: A 12-mile section of State Sign Route 96 between one mile north of Somes Bar and Ti Creek, generally following the alignment of the existing highway through difficult terrain, but with easier grades and curves; and 1.8 miles on new Route 3 (former Route 82) easterly from the adopted route for Interstate 5 east of Yreka.

In another commission route action, a short section of old State Sign Route 1, from its junction with new Route 46 (former State Sign Route 41) at Cambria to 1.3 miles westerly, was redesignated as an extension of the latter highway, and a 350-foot connection was adopted between the redesignated section and the new State Sign Route 1 Expressway.

FIAT LUX!

Our caption to the front cover of the May-June issue of the magazine, in a burst of poetic enthusiasm, wrongly attributed the illumination on the lower deck of the San Francisco-Oakland Bay Bridge to headlights of eastbound traffic rather than to its true source, the fluorescent lighting system recently installed by the Division of Bay Toll Crossings.

Human Relations Coordinator Named

Another step toward assuring equal job opportunity in the California Division of Highways was taken by State Highway Engineer J. C. Womack by the designation of a human relations coordinator for the division, in line with Governor Edmund G. Brown's request to state agencies.

Scott H. Lathrop, principal highway engineer in charge of personnel and public information for the division, was appointed to serve as human relations coordinator. The assignment is in addition to his regular administrative duties.

At the same time Womack ordered statewide distribution to each district engineer, equipment shop superintendent and department head in the division a copy of the instructional booklet entitled "Promoting Equal Job Opportunity—A Guide for Employers," which was issued recently by the State Fair Employment Practices Commission.

Lathrop's job, Womack said, will be to see that the Division of Highways continues and intensifies its efforts to follow existing directives by Governor Brown and State Director of Public Works John Erreca in recruiting, appointing, and promoting highway employees.

"We have already placed in the hands of every division employee," Womack said, "a copy of the Governor's 'Code of Fair Practices' leaflet and Mr. Erreca's circular letter of last August, which calls for 'affirmative and positive action,' not just being against discrimination. I have instructed Mr. Lathrop to follow through to ascertain that all actions involving our employees continue to be on the basis of merit and fitness, without regard to race, color, religion, national origin, or ancestry."

Lathrop has been in charge of personnel administration for the Division of Highways for the past seven years. He is a civil engineering graduate of the University of California. He has served continuously with the Division of Highways in various engineering and administrative assignments since 1931, except for World War II service in the U.S. Navy.

In 1959 the Sacramento Section of the American Society of Civil Engineers honored Lathrop with its annual "Engineer of the Year" award for community service. He recently served two one-year terms as president of the Sacramento Council of Churches.

Peddy Is Appointed Project Control Head

Appointment of Jack E. Peddy to the newly established position of project control engineer for the California Division of Highways has been announced by State Highway Engineer J. C. Womack.

Peddy was promoted from his position as assistant programs and budgets engineer, an assignment he had held for three years.

His new duties involve working out and putting into effect procedures for the most effective assignment of planning and design personnel to highway projects in the preliminary engineering stage, Womack said. In addition, he will assist in keeping state legislators informed on highway planning and construction scheduling.

JACK E. PEDDY

Both these assignments, Womack pointed out, are in line with Peddy's recent duties, which have included staff work in connection with the preparation of the annual State Highway Budget and with the scheduling of bid advertising to insure a continuous flow of contract work; and appearances before civic organizations throughout California to report on highway planning and development.

Peddy has been a Division of Highways employee since March, 1948. Born and raised in Fresno, he received his bachelor's degree in civil engineering from the University of Michigan in 1946 while participating in the US Marine Corps college training program.

After two years in engineering work in the aviation industry, Peddy joined the Division of Highways staff in the District VI office in Fresno. His earlier assignments were in design, and later he was transferred to construction and was resident engineer on freeway contracts on US 99. Later he advanced to district construction engineer in charge of projects in Fresno, Madera and Kings Counties, and in October, 1958, became the district's advance planning engineer in charge of route location studies.

His service in the Fresno district was interrupted for a year and half by his recall to active Marine Corps duty in the Korean war, where he saw combat duty as an artillery officer.

In August, 1961, Peddy was promoted to his division headquarters position in the programs and budgets department.

Peddy is married and has two sons and a daughter.

Violet E. Randle

Mrs. Violet E. Randle, Secretary I in the Division of Highways District I office at Eureka, died on July 5 after a long illness.

During her career with the Division she served as secretary to five district engineers: G. F. Hellesoe, A. M. Nash, C. V. Kane, Alan S. Hart and Sam Helwer.

She started work as a junior stenographer in 1946.

Mrs. Randle was born in the Dyerville area. She attended Eureka elementary schools and graduated from high school in San Francisco.

Before coming to the Division of Highways, she was employed by the State Department of Education for two years.

She is survived by her husband, Lee, and two daughters, Patricia, 15, and Rebecca, 8.

Division Announces Latest Retired List

District II

John Q. Cox, highway maintenance man I, 32 years; Clifford P. Higgins, highway foreman, 41 years; Lee Y. Stewart, highway maintenance man I, 12 years.

District III

Dewey E. Allison, highway maintenance man I, 20 years; Curtis H. Kronquest, highway maintenance man I, 9 years.

District IV

Paul Cowgill, highway chief clerk II, 31 years; Franklin K. Gurley, assistant highway engineer, 16 years; Joseph D. Silvera, highway maintenance man II, 30 years.

District V

Claribel S. Babcock, intermediate clerk, 16 years.

District VII

Jerome J. Fisher, highway field office assistant, 12 years; Edward L. Mahoney, highway foreman, 32 years.

District VIII

Ann M. Thomas, intermediate clerk, 12 years; Edgar A. Kellam, junior staff analyst, 13 years.

District XI

Donald B. Frazee, highway maintenance man III, 34 years; Jay V. Sperry, highway maintenance man II, 30 years.

Headquarters Office

Samuel R. Offutt, associate highway engineer, 16 years.

Bridge

Ralph M. Sherick, senior bridge engineer, 31 years.

Headquarters Shop

Russell L. Anderson, mechanics helper, 17 years; Thomas S. Cardona, heavy equipment mechanic, 32 years.

Shop 5

Charles B. Bradfield, automobile mechanic, 19 years.

Bridge Department's R. M. Sherick Leaves

Ralph M. Sherick, Senior Bridge Engineer, in the Advance Planning Section of the Bridge Department, retired on May 31 after 31 years in state service.

A native of the Golden State, Sherick attended San Diego High School and San Diego State College, and graduated from the University of Southern California with a degree of Bachelor of Science in Civil Engineering in 1926.

RALPH M. SHERICK

Sherick's assignments have taken him statewide since he came to work with the department in November, 1933. He served as resident engineer on bridge construction projects both in Southern California and Northern California, and became area construction engineer for the north coastal counties in July of 1947. In 1954 Sherick transferred to the Advance Planning Section, assuming charge of the Report Writing and Review Section.

During World War II he served in the Seabees in the Pacific Theater with the rank of Lieutenant Commander.

Sherick is a past president of the Capitol City Toastmasters Club and is affiliated with the Masonic Lodge in Los Angeles and the York Rite bodies and Ben Ali Temple of the Shrine in Sacramento.

C. Clarke Waterman Retires on July 1

C. Clarke Waterman, District Accounting Officer for the Division of Highways at San Bernardino for more than 22 years, retired on July 1.

Waterman, a native of Buffalo, New York, and a registered public accountant, began work with the division in San Bernardino in May, 1941, as departmental accounting officer, transferring from the Department of Finance and Franchise Tax Commission in Sacramento, with which he had served from 1939.

Ray E. O'Bier

Ray E. O'Bier, Assistant Chief Right-of-way Agent for the California Division of Highways, died suddenly on June 4 in Sacramento. A native of Texas, he had previously lived in San Bernardino 33 years, where he was in charge of the Right-of-way Department of the local Division of Highways District Office from 1945 until his promotion and transfer to Sacramento in 1961.

O'Bier was educated in Texas and took courses in engineering after he moved to California. He came to San Bernardino in 1927 to join the Division of Highways as a member of a survey party. He continued in engineering work until 1935 when he transferred to the Right-of-way Department, where he served continuously until the date of his death. He was 56.

O'Bier was a member of the American Right-of-way Association and American Association of State Highway Officials, a Past Master of the San Bernardino Lodge No. 348 F. & A.M., a member of the Elks, an associate member of the San Bernardino Real Estate Board, and past president of California State Employees Association Chapter No. 7.

He is survived by his wife, Margaret; two sons, Ray, Jr., of San Bernardino, and Gordon, who is with the Fifth Army in Germany; his mother, Mrs. Elizabeth Christensen of San Gabriel, and three sisters, a brother, and two grandchildren.

KOFMAN IS VICE-CHAIRMAN

The California Highway Commission has elected Abraham Kofman of Alameda as its Vice-chairman, succeeding Arthur T. Luddy of Sacramento, who resigned from the Commission recently because of ill health.

Kofman, a San Francisco Bay Area newspaper publisher, was appointed a member of the Commission by Governor Edmund G. Brown in September, 1961. He was reappointed in January, 1964, to a four-year term.

Tempus Fugit Column

The following items appeared 25 years ago in *California Highways and Public Works:*

July, 1939—Realignment of Russian River Highway Nearing Completion

One of the most popular vacation spots in Northern California—the section between Northwood Park and Guerneville on the Russian River—will soon be served by a new highway having easy curves and very light grades, and using the roadbed of the abandoned Northwestern Pacific Railroad.

It replaces the narrow, winding road originally built to serve the lumber industry, which concluded operations about 1919.

The new 36-foot highway closely follows the river along its entire 3¼-mile length, and passes through the beautiful redwood stands in Guerneville Park.

Placing of steel tie rods in construction of retaining walls proved a problem, as did construction of two concrete bridges on timber pile bents.

July, 1939—New Divided Approach to City of Merced Solves Flood Problem

Another unit of four-lane divided highway on US 99, Golden State Highway, has been completed, extending for 5.7 miles southeasterly from Merced.

Due to a series of wet winters and changed conditions caused by irrigation ditches and other factors, the highways in the vicinity of Merced have been flooded for four consecutive winters, beginning with 1935.

US 99 was the most immediate problem, with its heavy local and through traffic which had to detour many miles for considerable periods due to the depth of flood waters.

The work in general consisted of widening the existing roadbed and building a new roadbed above the flood land, and constructing new drainage structures in the old roadbed.

The project will be in effect a four-way divided highway most of the time. During extreme floods, there may be period of a few days when the old road will be closed and traffic will use the new high grade as a two-way road until the flood waters subside.

August, 1939—Hydraulicking Highway Cut 210 Feet Deep Completed Through Mountain

10,748,000 cubic yards of earth were moved in this huge Trinity County project completed June 30. Approaches to it from Weaverville and Junction City will be completed early in 1940 . . . 25 years after the State Highways Act of 1915 provided for "an extension connecting the interior and coast trunk lines in Northern California through Trinity and Humboldt Counties, by the most direct and practicable route." The final interpretation of this called for an extension of the existing county sea/lateral from Weaverville, rather than a route from Douglas City, seven miles south of Weaverville.

This decision posed problems for highway engineers and it was decided to make the cut by hydraulic means, which proved successful and economical. Operations began in early 1933. Average rate of excavation was 8,060 cubic yards per day.

The cut, 2,500 feet in length, is 2,000 feet across the top, with bottom width varying from 50 to 250 feet. It reduces the distance between Weaverville and Junction City by 2½ miles. (First survey over the mountain between the two towns was 10½ miles long.)

August, 1939—Santa Monica Grade Separation Project Solves Coast Route Problem

The Colorado Avenue grade separation in Santa Monica will be constructed during the next nine months under a cooperative PWA contract by the city for the purpose of relieving one of the most congested and hazardous intersections on the Roosevelt Highway along the coast—one of the most heavily traveled routes in the State.

IN MEMORIAM

District II

Miles H. Elder, Highway Maintenance Man II

District IV

Joseph P. Sinclair, Metropolitan District Engineer

Mervin W. Nauert, Highway Maintenance Man II

District VII

Leonard W. Ford, Assistant Highway Engineer

District VIII

Evan G. Bower, Supervising Highway Engineer

This will consist of a 650-foot bridge carrying Colorado Avenue over Ocean Avenue, the Roosevelt Highway and the connection to Appian Way to provide a direct connection with the Santa Monica Municipal Pier, for both vehicles and pedestrians. This will greatly facilitate traffic movement, and also provide greater access to the Ocean Park area and to the highly developed beach area immediately south of the pier. Free interchange of traffic will be afforded through ramps and connections.

August, 1939—An article by Landscape Engineer Dana Bowers discussing practical roadside development points out that after some 10 years of trial, the original conception of roadside development (consisting principally of planting of trees, shrubs and flowers) is gradually giving way to the broader, more appropriate and practical concept which strives for more harmonious setting of the roadway into contours of landscape.

Two basic requirements govern an economic and aesthetic plan of highway landscape design, he points out. The cross section, or foundation, upon which the landscape plan must be fabricated requires consideration. Also, there is need for a fertile top soil blanket on newly exposed slopes to hasten revegetation and prevent erosion.

Right of Way Agents Attend 2nd Academy

The second two-week summer training academy for Division of Highways right-of-way agents was conducted August 3-15 at the University of California in Davis.

Approximately 80 of the division's junior agents and some of its newer assistant agents from the State's 11 highway districts received this concentrated 88-hour course of technical training in property acquisition and related fields.

In California's highway program, most of the land required for freeway and highway construction is purchased from private owners. Right-of-way agents are responsible for appraising these lands, negotiating their purchase, and managing them until construction begins. In the 1963-64 fiscal year, approximately 8,000 such transactions were made, representing an expenditure of nearly $180,000,000.

"The improved productivity demonstrated by agents attending last year's academy—which already represented the top 10 percent of applicants for a right-of-way career—proves the value of the course," said J. C. Womack, State Highway Engineer. "It also spells economy in both time and money because it speeds up the translation of highway user taxes into safe, modern highways and freeways. Also, because right-of-way work is tremendously varied, our agents must supplement technical knowledge of real estate laws and values with recognition that rights of the public and the property owner must be protected. Agents must merit the public's confidence and good will through care, courtesy, and constructive cooperation."

Classroom sessions incorporated: The Right-of-Way Function (¼ day); Right-of-Way Engineering (3 days); Appraisals (3½ days); Acquisition (3½ days); property management (½ day) and Examinations (½ day).

Senior members of the division's right-of-way staff served as instructors. Group conferences were scheduled as evening sessions. Classes were held in the Physical Sciences Building and Olson Hall on the Davis campus, and residence were in Bixby Hall.

Rudolf Hess, Chief Right-of-Way Agent for the Division of Highways, supervised plans and curriculum for the academy, which offered opportunity for a uniform instructional pattern for agents who will apply this training in their respective districts throughout the State.

DIVISION EXPANDS ROADSIDE DEVELOPMENT SECTION

Expansion and reorganization of the roadside development and landscaping program of the California Division of Highways, including establishment of a new position of Principal Landscape Architect, has been announced by State Highway Engineer J. C. Womack.

D. P. VAN RIPER

Donald P. Van Riper, for the past 17 years in charge of landscape architectural activities for the State Office of Architecture and Construction (formerly Division of Architecture), has been appointed to the new position.

Van Riper will not only assume responsibility for the State's 30-year-old roadside planting program, which now involves more than $4,000,000 in new projects annually, but will also work with all units of the division involved in the scenic highway and roadside rest program. In addition, Womack said, he will act as consultant to other state agencies and groups, notably the Governor's Advisory Committee on Scenic Highways.

"Roadside development and aesthetics have been an increasingly important part of the state highway program for a long time," Womack pointed out. "In the past few years, the concepts of highway planning and design have expanded beyond the basic considerations of safe and efficient traffic movement, and we are thinking in terms of the driving environment, the whole corridor through which the road passes.

"We are fortunate," he added, "in finding a man of Mr. Van Riper's professional qualifications, long and varied experience and knowledge of state procedures to handle this broadened program."

The reorganization plan advances roadside development to department status, with Van Riper reporting to Assistant State Highway Engineer G. A. Hill, who is in charge of all planning functions.

Van Riper has been a professional landscape architect since his graduation with a bachelor of science degree in that field in 1929 from the University of California, Berkeley.

A native of Newcastle, Placer County, he attended Placer Union High School in Auburn before attending the university. He received his master of science degree in 1932.

His first career activity was with the National Park Service, where he engaged in both design and construction work for Yosemite and Glacier National Parks. Later he was landscape architect for WPA projects in the San Francisco Bay area, and prepared site development plans for the Hollywood Park race track at Inglewood.

From May 1939, to June 1947, with the exception of 3½ years of service as a Navy officer in World War II, Van Riper was landscape architect and assistant to the superintendent of parks for the City of Sacramento.

He entered state service with the Architecture office in June 1947, as senior landscape architect and was promoted to supervising landscape architect two years later. In this position he has been responsible for site planning and development programs and related activities in connection with state building projects of all types.

Van Riper is married and lives in Sacramento. He is a member of the American Society of Landscape Architects. His local affiliations include the Sacramento Planning and Research Council and the Save the American River Association.

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EDMUND G. BROWN, *Governor*

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Wrong-Way Warning

Red Light, Horn, Sign Will Alert Motorist

The driver who tries to enter a freeway by going the wrong way onto a ramp meant for off-bound traffic now has sight and sound working to protect him at one test location in the state highway system.

Once he makes a wrong-way decision, his action triggers a series of devices intended to jar him into comprehension of his mistake and, in turn, into immediate remedial action.

The moment his wheels touch an inconspicuous detector buried in the pavement, a 12-inch red light goes on, a horn emits a blaring sound, and an ominous red sign (bearing the message "Go Back You Are Going Wrong Way") becomes visible.

This series of warning devices is part of an experimental project launched by the State Division of Highways Traffic Department in an attempt to reduce accidents caused by wrong-way drivers.

Statistics show that approximately eight percent of fatal freeway accidents are caused by wrong-way movements, and many more persons—including the innocent victims proceeding unwarned in the right direction—are injured.

About four out of ten wrong-way incidents on freeways occur because vehicles are entering at off-ramps. Since the off-ramp is one instance where engineering ingenuity can offer considerable hope toward a solution, concentrated effort is currently being expended in this area. The experimental project is an outgrowth of this study.

The experiment, at an interchange in the Sacramento area, also incorporates advance warning for the unsuspecting right-way motorist. At the time the red light beams toward the wrong-way vehicle, an amber light flashes the other way, warning oncoming motorists that there is a need for caution.

The detector which activates the warning devices is sensitive to all wrong-way vehicles but is designed so that the movements of right-way vehicles pass unnoticed.

Evaluation of the current project will be made possible by use of a counter which will record the frequency with which the warning signs are made operational by erring motorists. The time of day as well as the date will be recorded. This will enable engineers to supplement their current information with more details on the prevalence of wrong-way movements, and will perhaps lead to other preventive measures.

The first attempt by traffic engineers to reduce the wrong-way problem was the painting of directional arrows at all freeway ramp locations. At other sites, double yellow pavement stripes have proved worthwhile where it is imperative that the motorist keep to the right.

Many people have advocated the installation of spiked barriers for use in eliminating wrong-way problems. This device, however, does not supply all the answers the engineers are seeking. For instance, once a car is disabled by the spikes—presumably with two or four blowouts—it may become a fixed-object target for the next right-way driver. In actual practice, as closely as can be estimated, in excess of 90 percent of freeway wrong-way drivers do manage, somehow, to correct their error without having an accident. This would not be true if motorists suddenly found themselves trapped with disabled vehicles.

It is hoped that the experimental sight-and-sound warning will do what other devices, including the spiked barrier, will not do: Solve the problem of wrong-way movement without leading to other accidents.

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National Highway Week—October 4-10

THE WHITE HOUSE
BY THE PRESIDENT OF THE UNITED STATES OF AMERICA
A PROCLAMATION

WHEREAS safe, efficient, and economical highway transportation is vital to our continued national growth; and

WHEREAS adequate highways promote the social and economic opportunities of every American, and strengthen the defense of our Nation; and

WHEREAS the Federal and State governments are engaged in a cooperative program for the accelerated construction of highways; and

WHEREAS the completion of the National System of Interstate and Defense Highways, and the improvement of other highways, is essential to the attainment of our needs for safe and adequate transportation; and

WHEREAS the death of 43,600 persons in traffic accidents last year emphasizes the need for highway improvements; and

WHEREAS I have directed that an accelerated attack on traffic accidents be undertaken through the Federal-aid Highway Program, with the cooperation of State and local governments:

NOW, THEREFORE, I, LYNDON B. JOHNSON, President of the United States of America, do hereby proclaim the week beginning October 4, 1964, as National Highway Week in recognition of the importance of highway transportation to the social and economic progress and defense of our Nation; and I urge the Governors of the States and mayors of cities to issue similar proclamations.

I also ask appropriate officials of the Federal, State and local governments, as well as public and private organizations and the general public, to join in this observance.

During this week, I urge all Americans to give recognition to the value of highway transportation to their own activities and to our national welfare.

IN WITNESS WHEREOF, I have hereunto set my hand and caused the Seal of the United States of America to be affixed.

DONE at the City of Washington this fourth day of September in the year of our Lord nineteen hundred and sixty-four, and of the INDEPENDENCE OF THE UNITED STATES OF AMERICA the one hundred and eighty-ninth.

By the President
DEAN RUSK
Secretary of State

LYNDON B. JOHNSON

GOVERNOR'S STATEMENT

On September 11 Governor Edmund G. Brown issued the following statement:

Part of California's lure for millions of residents and tourists lies in the diversity of its natural scenic grandeur, majestically framed by mountains or carved by the mighty Pacific surf.

California's pioneering freeway law 25 years ago helped put this drawing card on display.

Today, a boldly executed skein of roads provides mobility for more than 10 million California vehicles and thousands of tourists. Today, no more than a day's drive separates the Sierra from the sea, or major metropolitan centers.

Although we have only 1,430 miles of full freeways, they bear 20 percent of our total travel. Despite this heavy traffic, our freeways have proven more than twice as safe per mile of travel as conventional roads.

So the Golden State's lure appropriately glistens with the silver anniversary polish of our freeway law during National Highway Week, October 4 through 10.

Therefore, Californians have special reason that week to rededicate themselves to the principles of sound transportation planning. As Governor, I also hope they pledge themselves to drive safely this year—and every year.

California Highways and Public Works

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Editors are invited to use information contained herein and to request prints of any black and white photographs.

Address communications to: EDITOR,

CALIFORNIA HIGHWAYS AND PUBLIC WORKS
P.O. Box 1499
SACRAMENTO, CALIFORNIA 95807

FRONT COVER: The future Interstate 280 will pass through the center of the Peninsula, linking San Francisco with San Jose and providing an alternate to the Bayshore Freeway (US 101). The Robledo Road structure (shown in picture) in Los Altos Hills will incorporate an equestrian path. (Painting by Jack C. Won.)

BACK COVER: The recently completed US 101 Freeway about a mile south of Myers Flat passes near the Lansdale Bar recreation area on the Eel River. The Avenue of the Giants, which the freeway has replaced as a through route, is visible in the left center of the picture. (Photo by John Meyerpeter.)

Highway 88

Historic Carson Pass Route Undergoes Major Improvements

By MICHAEL L. McGINLEY, Highway Administrative Officer

This route has been known as the Carson Pass Highway ever since the famous scout and trapper, Kit Carson, led Captain John C. Frémont's exploring expedition over the Sierra Nevada Mountains in 1844. It was first opened to wagon travel in 1849 and became an emigrant road during the gold rush days. Travel increased, tollgates appeared and, although certain sections of the road were kept in some semblance of repair, old emigrant trains trundled for miles through murky clouds of powdered dirt.

During the early thirties, asphaltic road oil was worked into this road to provide a smooth, dustless surface. Until realigning or grading work was

PHOTO ABOVE—A smoother, wider, safer alignment replaces the old road (right) at Woodfords. PHOTO BELOW—Motorists are warned of possible delays on Highway 88 just east of Jackson.

performed, as indicated on the chart, this highway was maintained in good condition. In 1959, it was included in the California freeway - expressway system. Planning and design studies are continuing with this highway, as they are with all highways throughout the State, to keep it as modern as possible within the limitations of available funds.

Extends 130 Miles

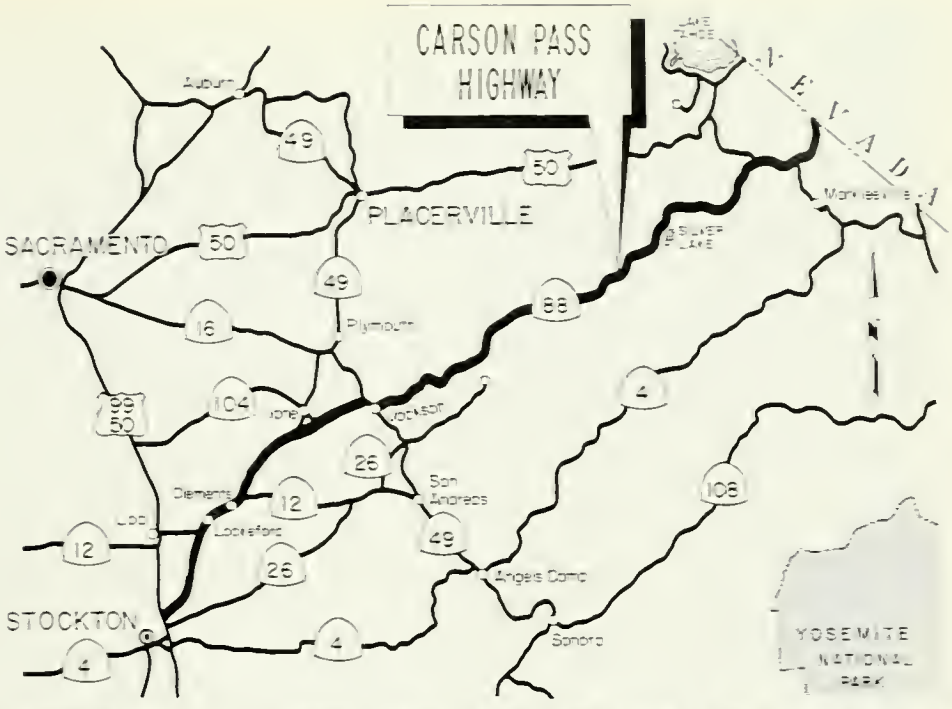
This route extends 130 miles from Stockton to Nevada and is one of the most scenic drives to the high vacation country south of Lake Tahoe. It runs through historic country made famous by the early trail blazers and the hardships of the '49ers.

Highway 88 is also the most direct route between Stockton and Lake Tahoe. It serves the communities of Lockeford, Clements, Ione, Jackson, Pine Grove, and the High Sierra areas between Cooks Station and the Nevada state line, including Silver Lake and Twin Lakes. In addition to the historical interest and recreational facilities, this route provides an outlet for lumber products from the Amador forests to the shipping docks in Stockton and the Bay area.

Going from west to east, Highway 88 leaves the flat San Joaquin Valley and gently ascends the Sierra foothills into Jackson. The many old stone and brick buildings built in the '50s make a side trip through this now-modern little city well worth while.

Sign Informs Motorist

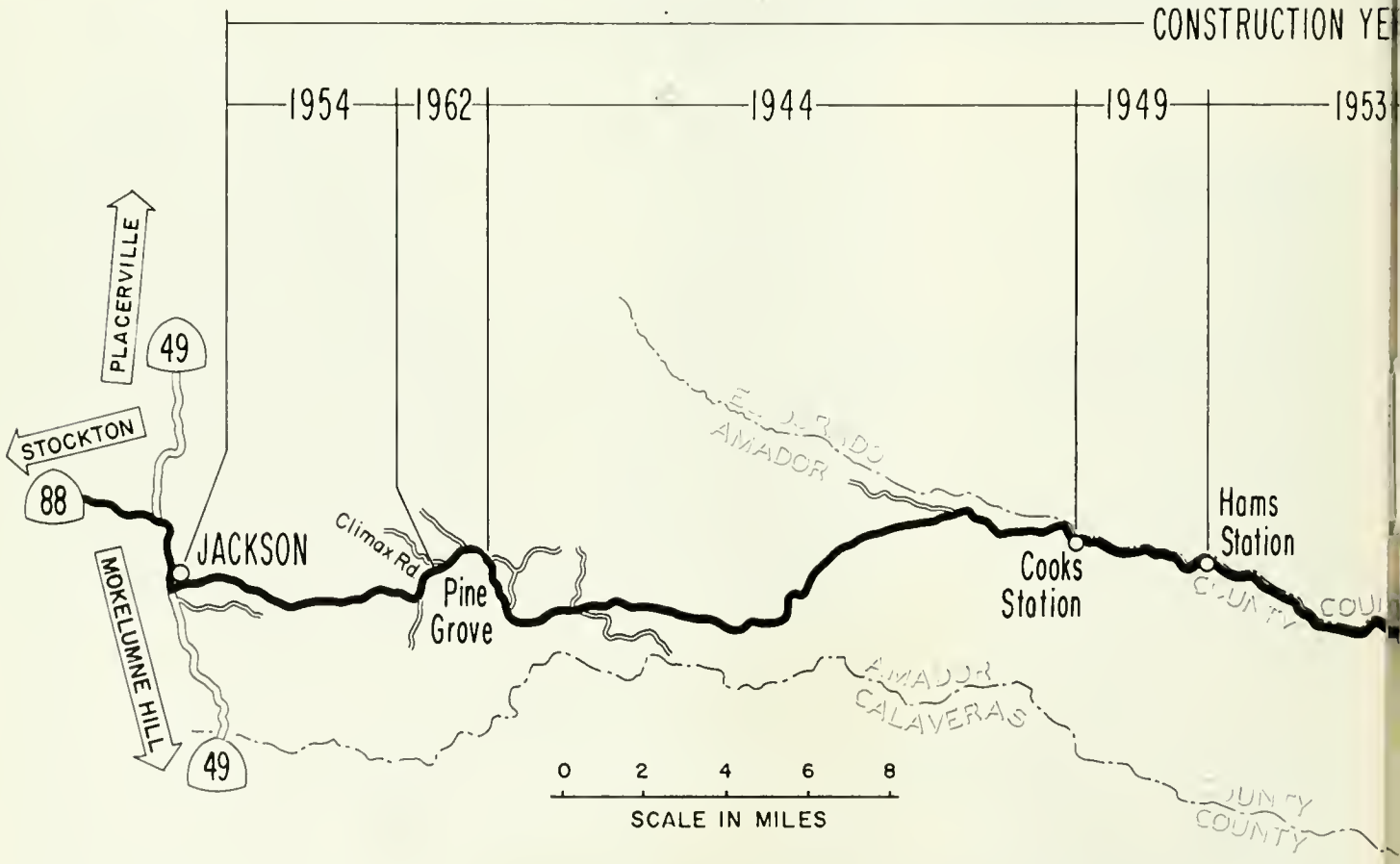
A sign posted just east of Jackson informs the motorist that Highway 88 is under construction and subject to delays of 2½ hours farther up the road. These delays are usually nominal and the detours short; however, the longer delays may occur because there are occasions when it is necessary to blast sections of this rugged and rocky granite terrain. The Division of Highways realizes that these delays inconvenience the motorist, especially during vacation time, but it is impossible to build roadways during the winter because of the snow.



Highway 88, the Carson Pass Highway, extends 130 miles from Stockton to the Nevada state line and is one of the most scenic drives to the high vacation country south of Lake Tahoe.

Panther Meadow, east of Hams Station, offers a variety on the scenery.

The once hazardous junction of Climax Road and Highway 88 has been made safer by channelization and widening.



Closing of this highway usually occurs with the first major winter storm and, due to the deep drifts, it is impossible to reopen it until the following spring. Therefore, the contractors have only about a four-month working period each year. They make the most of it by working long hours, Saturdays and holidays.

East of Jackson

In 1954, a 6.3-mile project was completed between just east of the city limits of Jackson and one mile west of Pine Grove.

This improvement provided a 32-foot all-paved roadway on a new alignment having a minimum radius of curvature of 600 feet, in contrast to a minimum of 200 feet on the old road. This project eliminated a section of narrow, twisting road.

Construction was completed during 1962 in the vicinity of Pine Grove to provide for the channelization of the junction of Climax Road, formerly used as a logging road, and the widening of Highway 88.

Portions Improved

Portions of the stretch of Carson Pass Highway between Pine Grove and Cooks Station were improved by widening and realignment in 1944. This section of highway traverses tree farms, forests of cedar, fir and pine. Planning studies are now underway to convert the existing two-lane road to modern freeway or expressway standards.

Although most of the existing highway is designed for a speed of about 40 miles per hour, there are a few well-posted sharp turns which are to be improved in future construction.

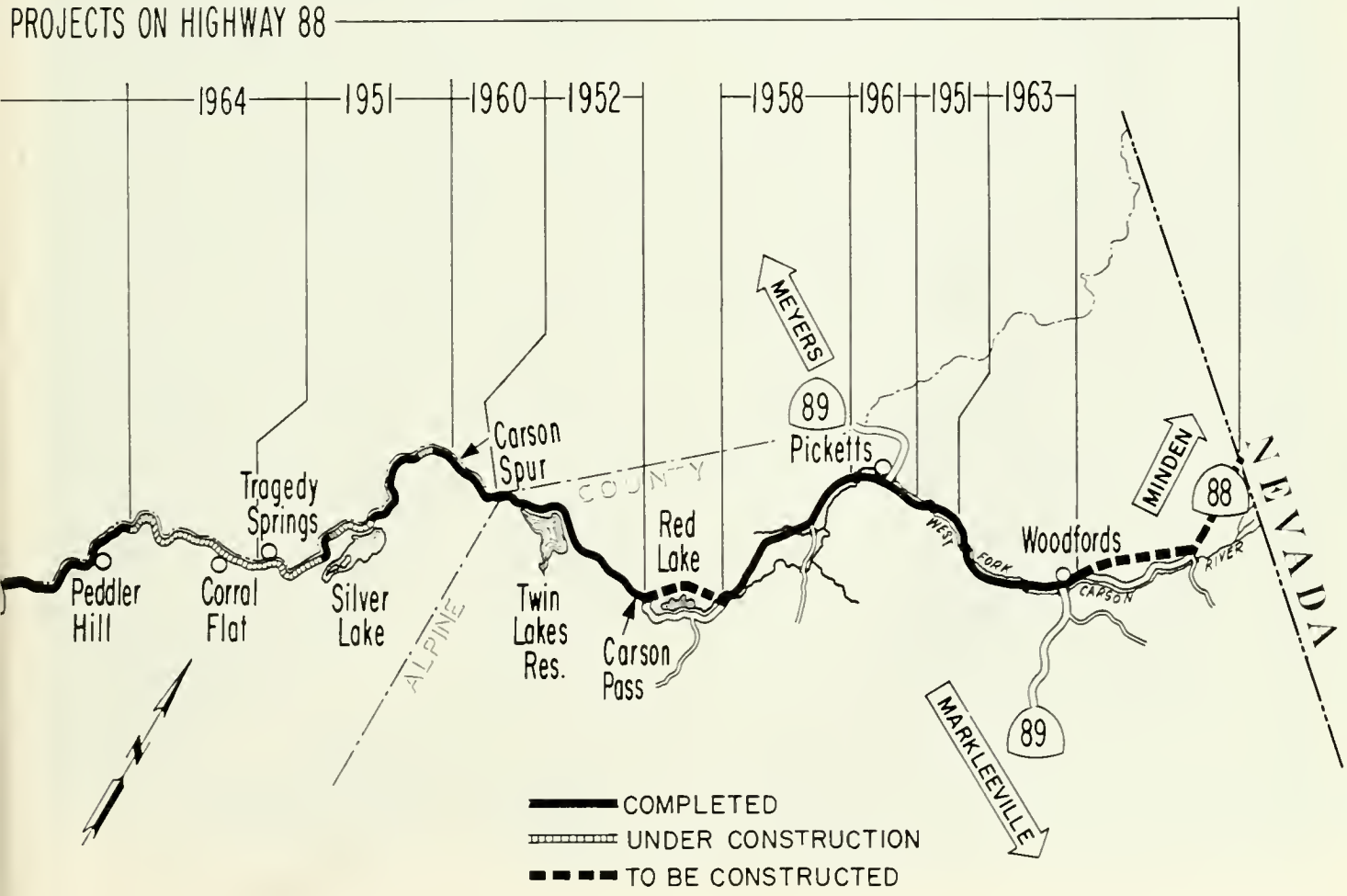
Highway Improved

A bituminous surface treatment improved the portion of the highway which climbs the broad, sloping divide between the Mokelumne River on the south, and the Cosumnes River to the north. This section between Cooks Station and Hams Station was completed in 1949.

Three Projects Completed

During the years 1953 through 1958, three projects were completed between Hams Station and about two miles east of Peddler Hill to provide a 26-foot all-paved section of highway in the Eldorado National Forest. From the vista point provided by the U. S. Forest Service at Peddler Hill, a popular winter ski area, is a magnificent view over the forested Mokelumne River watershed and the Bear River Reservoir.

Now completed is a $1.25 million project located about 41 miles east of Jackson. Involving some 5.5 miles of realignment, this project is located between Peddler Hill and Tragedy Springs on the heavily timbered ridge between the Mokelumne and American Rivers at an elevation of more than 7,000 feet.



Sharp turns are well posted where it was necessary to blend the highway with the terrain to preserve the beauty of the surraundings.

Continuation of Project

A continuation of the above project extends from Tragedy Springs past Silver Lake to the Carson Spur about 2.5 miles west of the Alpine county line. Roadway improvement costing $1,600,000 is about 50 percent complete and is expected to be finished in the fall of 1965.

The delay noted on the signs posted at either end of Highway 88, where an alternate route may be chosen by the motorist to go over the Sierra, might occur here. This is where the motorist will be given the opportunity of viewing the ruggedness of the terrain. Solid walls of granite are being blasted to provide a safer, smoother roadway so that the scenic beauty and historic values will be within easy reach of everyone. Since this project is located in the Eldorado National Forest, the blasting operations must be conducted with a minimum of damage to the trees outside of the right of way. The problem is to break up the granite so that it can be loaded with a power shovel and still not throw rock into the trees and cabins in the area.

Portable "Hot Plant"

Another sight that can be seen from the detour road is the "hot plant" where asphalt concrete is mixed for surfacing the project mentioned above. This plant is entirely portable, permitting it to be moved from one construction site to another. This "hot plant," or batch plant as it is usually called, produces about 150 tons of asphalt concrete per hour. There are seven rock crushers operating just west of Silver Lake which provide crushed rock for aggregate base, asphalt concrete material, and permeable material to be used for drainage and filtering purposes. These crushers are capable of making any size aggregate material.

The portions of this route between Tragedy Springs and Carson Spur which were not reconstructed in 1951 (see sketch map) are those which are now under construction as described above. The road winds down through the forest to the west shore of Silver Lake. This lake is nearly two miles long and is a favorite spot for fishermen and boating enthusiasts. Improved

A power shovel loads granite rock on dump trucks after blasting operations near Silver Lake.

A new portable batch or "hot plant" near Silver Lake prepares asphalt concrete for the new highway.

An asphalt spreader (foreground) and a bottom-dump truck add finishing touches to the new roadway between Peddler Hill and Tragedy Springs.

The nearly completed roadway on new alignment (right) has wide, sweeping curves and gentle grades.

campgrounds and resorts await those who enjoy relaxing in the scenic splendor of this area.

Work was completed in 1960 at a cost of almost $400,000 on a little over two miles of relocation of the Carson Pass Highway from the Carson Spur to just east of the Alpine County line. The work involved heavy grading to improve the alignment and eliminated a steep sidehill section with heavy curvature. This improvement also increased the sight distance, which is the length of highway ahead visible to the driver.

Red Lake Grade

Similar work was completed in 1952 from the easterly section of the above stretch of highway past Twin Lakes Reservoir to the Carson Pass near the top of Red Lake Grade. After leaving a beautiful mountain meadow near the Alpine county line at the beginning of this portion of the highway, it climbs easterly to the base of the dam at the west end of the reservoir. Near the water level it curves around the lake where water sports and fishing are popular. The highway continues to ascend gradually until it reaches an elevation of 8,573 feet at Carson Pass.

The existing section of the Carson Pass Highway from the top of Red Lake Grade to the bottom of the grade at the easterly tip of Red Lake closely follows the alignment of the original emigrant trail. Since it was first oiled in the early thirties, no major realignment or grading work has been performed, but efficient maintenance has kept it in good condition. The deficiencies of this portion of the present facility include inadequate width, excessive grade, and substandard alignment with restricted horizontal and vertical sight distances. The northern exposure makes it the last portion of road to be cleared of snow each year.

The Alpine County Board of Supervisors, local civic bodies, and the Highway 88 Association actively promoted the improvement of this route and, in 1961, the California Highway Commission adopted a route to relocate this highway on the north side of the Lake. This new location will

The Bear River Reservoir viewed from the U.S. Forest Service vista point at Peddler Hill.

The summit at Kit Carson Pass, 8,573 feet above sea level.

Looking toward Jackson on Highway 88 showing how the road was leveled out and widened.

provide lighter grades, greater width, sweeping turns, and a better exposure to the sun, thus permitting it to be opened earlier in the spring.

Design Completed

Design has been completed and right-of-way acquisition is expected to begin in late 1964 or early 1965 for a new 32-foot-wide, all-paved, 2.5-mile section of this highway on the north side of Red Lake. Consideration may be given to financing this project from federal forest highway funds.

A new road was completed in 1958 between Red Lake and the West Fork of the Carson River. The area traversed by this 5.9-mile project is a wide, grassy, pastureland. The meadows lie to the north of the highway while the pine trees begin to find their way up the slope of the mountains to the south of the highway. This road is used primarily by vacationers bound for, or coming from, the High Sierra.

In 1961, the highway was realigned, widened, graded and paved from the Carson River to about a mile and a half east of Picketts.

Similar work was completed in 1951 on a stretch of highway immediately east of the portion described above to 2.5 miles east of Picketts.

Continuing east, similar construction was completed in 1963 from the point last mentioned above to three-tenths of a mile east of Woodfords.

Design plans have been completed and right-of-way acquisition is in progress to replace the existing narrow, winding two-lane road just east of Woodfords to the Nevada state line with a new and wider two-lane expressway. Construction is dependent on the future availability of funds.

No matter which way the Carson Pass Highway is traversed, this scenic and historic route has enough variety to interest the most seasoned traveler, the avid fisherman, and the experienced hunter.

The Division of Highways is constantly planning and designing safer highways to make driving more pleasant. During planning and design stages, every effort is made to fit the alignment to the terrain, thus preserving the scenic beauty and the natural environment of the area.

State Freeways Save 400 Lives Each Year

More than 400 lives per year are saved because of California's freeways according to State Highway Engineer J. C. Womack.

Womack made this statement in connection with National Highway Week (October 4–10). He added that the 1,448 miles of freeway now open in California have a safety record nearly three times better than the average road or street.

In 1961 and 1962, an estimated 27,750 accidents were avoided because of freeways, and about 41,800 persons escaped injury. For this two-year period, 831 lives were spared. In addition, he noted, untold time, money, and personal anguish were saved.

The safety record will improve, Womack said, as mileage is added to the statewide freeway and expressway system. By 1980, the target date for completion of the system, the State will have a freeway and expressway network of 12,414 miles.

Route 299 Expressway

By JOHN V. KELLY and RAY HUCK, Resident Engineers

The completion in July 1964 of a 3.3-mile section of a two-lane expressway between 4.5 and 7.8 miles northeast of the Town of Adin, through Rush Creek Canyon, was the final step in providing 40 miles of carefree driving on Route 299 in Modoc County between Adin and Alturas.

This latest addition to California's freeway and expressway network replaced an old road constructed in 1925 by the U.S. Bureau of Public Roads. The alignment of the old highway included 11 curves, 5 with radii from 300 feet to 400 feet, separated by short tangents. In the best weather it was difficult to negotiate portions of this road in excess of 30 miles per hour. In snow or ice, quite common at this 4,500-foot elevation, the driving could only be described as hazardous. The new road has a design speed of 70 miles per hour, and incorporates many of the features of a freeway in its layout.

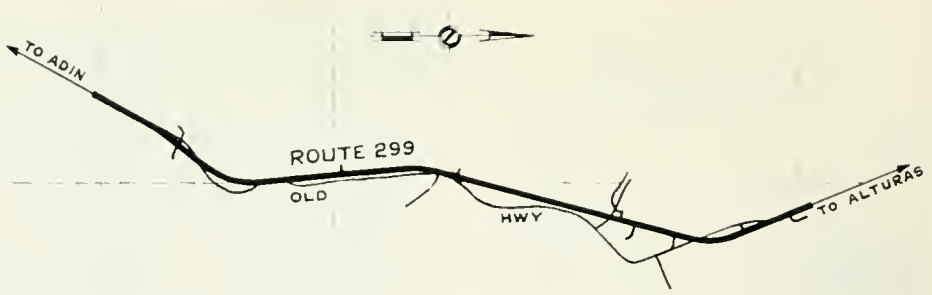
Unusual Feature

Reinforced concrete bridges, one 140 feet long and another 100 feet long, span the two crossings of Rush Creek, replacing the old narrow struc-

The completed expressway through this mountainous area is constructed to a design speed of 70 miles an hour.

tures. An unusual feature of this construction is a fenced public stock trail extending the full length of the project, and generally following the alignment of the original road.

Though often overshadowed by California's impressive progress in constructing new multilane freeways, the history of Route 299 in Modoc County during the past 10 years has been one of constant improvement. More than 16 miles of the Route between Adin and Alturas have been reconstructed during this period. Nine miles are two-lane expressway on new alignment. In addition to providing regulated access, wider roadways, fewer steep grades, and flatter



The improved alignment of the new Route 299 Expressway is apparent from the old and new routes shown on the above map.

curves, the new expressway sections have sufficient right-of-way for ultimate expansion to four lanes, thus protecting the highway users' investment against future increases in right-of-way costs.

Pit River Bridge

Ray Kizer and Ray Kizer Construction Company, Inc., was the successful bidder on the two most recent contracts on this route. Besides the Rush Creek Canyon sections, they

A winter view of Route 299 at Rush Creek before reconstruction.

Sharp curves and snow combined to make travel slow and dangerous on the old highway.

completed the 5.8-mile portion in 1962 from 0.4 mile west of the Pit River Bridge to 1 mile east of Canby. The new Pit River Bridge is a reinforced concrete girder structure, 305 feet long.

The portion of Route 299 from 1 mile east of Canby to Chamber's Ranch, a distance of 7.3 miles, was constructed by Peter Kiewit Sons Company of San Francisco in 1954. This stretch has a 32-foot roadbed and good geometric design, but no restricted access.

Further Improvement

Plans for further improvement of the route call for reconstruction to expressway standards after 1971 of the 9-mile portion between the Rush Creek and the Canby projects. This section rises gradually from an elevation of 4,300 feet at the new Rush Creek Bridge to 5,173 feet at Adin Summit, then descends to the new Pit River crossing. This section was constructed in 1940 to very high standards for that time.

Plans for the proposed Round Valley reservoir site just north of Adin have delayed establishing a freeway route from Adin to Rush Creek. The State Water Resources Department and the U.S. Bureau of Reclamation are currently studying the feasibility of including this dam in the Upper Pit River development for the irrigation of Big Valley. Continuing the past record of improvement of Route 299 will insure the citizens of Modoc County, and of California, easy and pleasant access to the fast developing recreational areas of Modoc County.

LEVIN NAMED STUDY CHIEF

Secretary of Commerce Luther H. Hodges has announced the designation of Dr. David H. Levin to direct a study to determine the feasibility of a national program of scenic roads and parkways.

Dr. Levin is deputy director of right-of-way and location in the Bureau of Public Roads, a unit of the U.S. Department of Commerce.

The Redwood Highway

Part III — *Bringing It Up to Modern Standards*

Early in 1952 the Legislature adopted Senate Concurrent Resolution 16 which said:

"WHEREAS, The welfare of the people of the State of California demands a free and uninterrupted flow of vehicular traffic and commerce at all times; and

"WHEREAS, Slow-moving trucks and buses and other heavily laden vehicles on dangerous grades greatly impede the flow of traffic until it is often brought to a standstill; and

"WHEREAS, This situation results in a dangerous condition of the highways which needs to be corrected for the safety of all highway users; now, therefore, be it

"*Resolved by the Senate of the State of California, the Assembly thereof concurring*, That the Legislature hereby requests the California Highway Commission to make a study to determine where it may be necessary to provide for the construction of four-lane highways on dangerous grades and curves on that portion of the State Highway US 101 from the San Francisco to the California-Oregon boundary; and be it further

"*Resolved*, That the Secretary of the Senate transmit copies of this resolution to each member of the California Highway Commission and the State Highway Engineer."

Widening Not Answer

In his reply State Highway Engineer G. T. McCoy said:

"In compliance with SCR No. 16 a detailed study has been made of the traffic conditions and physical characteristics of the route, and from this study it was apparent that it was not practicable to isolate and limit the evaluation of the need for construction of a multilane highway to the specific sections which could be considered as being dangerous grades and curves."

The State Highway Engineer reported that traffic on this route was increasing more rapidly than on the system as a whole; that the rate was particularly marked in the summer quarter when industrial and recreational traffic merged and reached a peak; that by 1960 60 percent of the mileage would be carrying an average daily traffic in excess of the critical figure of 5,000 vehicles. He also pointed out that alignment was unsuitable for modern travel, 55 percent of it having been built 25 or more years before. (As we have seen, the surveys for large portions of the route were made 50 years ago.)

The State Highway Engineer's report further stated that along 246 miles of 101 between San Francisco and Crescent City, or nearly 65 percent of the total mileage, and over nearly 90 percent of the route from Crescent City to the Oregon border, the sight distance was restricted to less than 1,600 feet. By minimum sight distance standards, it was unsafe to pass on great portions of the highway.

The report also noted that 47 percent of the distance between San Francisco and Crescent City on 101 was on curving alignment, and on the section between Crescent City and the Oregon border 85 percent was on curving alignment.

From these studies it was concluded in 1952 that 224 miles of existing 101 highway should be widened as soon as financially possible, to provide a "multilane, divided, access-controlled highway facility"; in other words, a freeway. It was also recognized that the remaining mileage would probably need improvement to freeway standards before funds would be available.

These roadside redwoods near an interchange just south of Santa Rosa are typical of the more than 5,000 redwoods planted by the Division of Highways along newly completed freeway sections of Highway 101 in Sonoma County. Trees in this photo were planted in 1959.

Scenic Factor

But by the 1950's another element was added to the engineer's problem. Not only must he modernize the Redwood Highway in almost impossible terrain and so design the route that it

Near Myers Flat, the new freeway carries the trucks and through traffic . . .

would stay in place during rainy winters with their sliding slopes and raging rivers, but he must now also think in terms of conserving the natural landscape. Increased mobility, increased leisure, increased wealth, added to greatly increased population and diminishing outdoor space, had made the magnificent Redwood groves of the Eel system more than ever a priceless heritage to pass on to generations to come.

Changing the Redwood Highway into a freeway was not a matter of ordinary realignment and improvement. It was a major project which could not expect to be completed for decades. It required the most careful and coordinated planning.

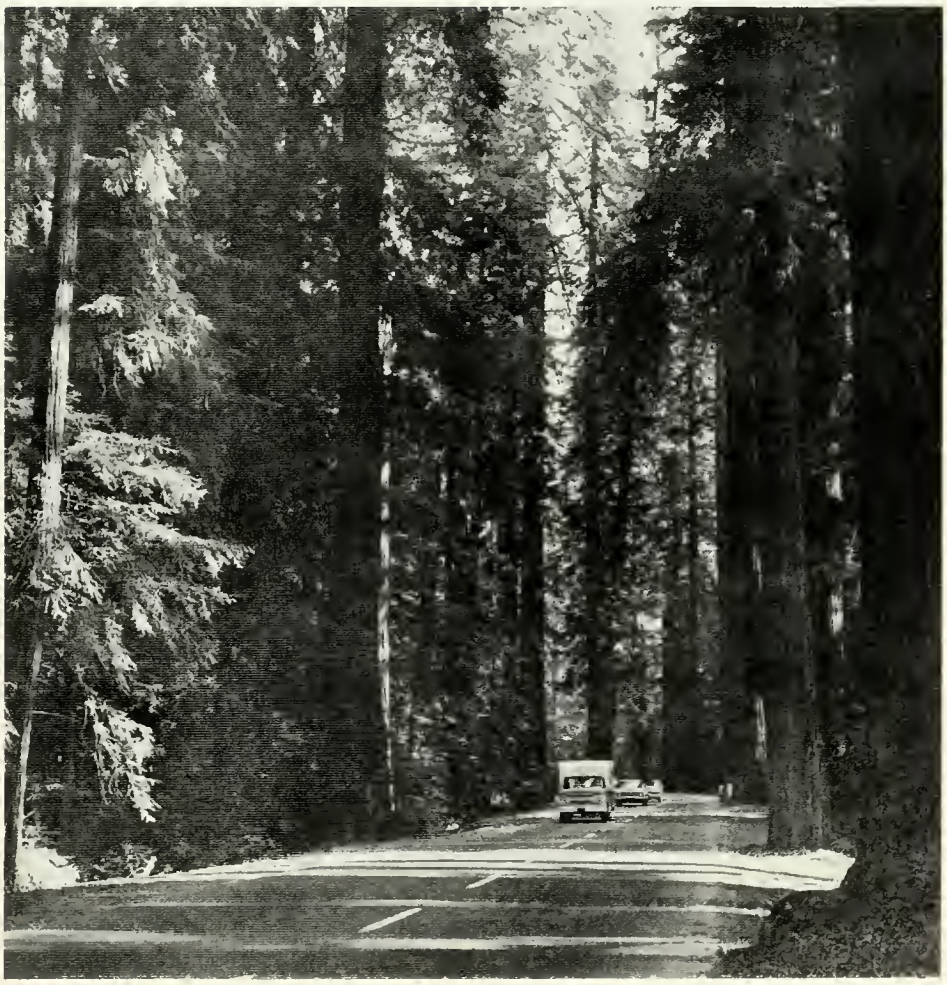
This was by no means a new concept with highway engineers. In 1912 the commission requested permission to buy 100 feet of redwoods on either side of the highway but funds could not be obtained. As early as the 1930's there were joint meetings between highway engineers and state park officials. Many small problems of realignment and improvement were discussed and usually satisfactory solutions arrived at.

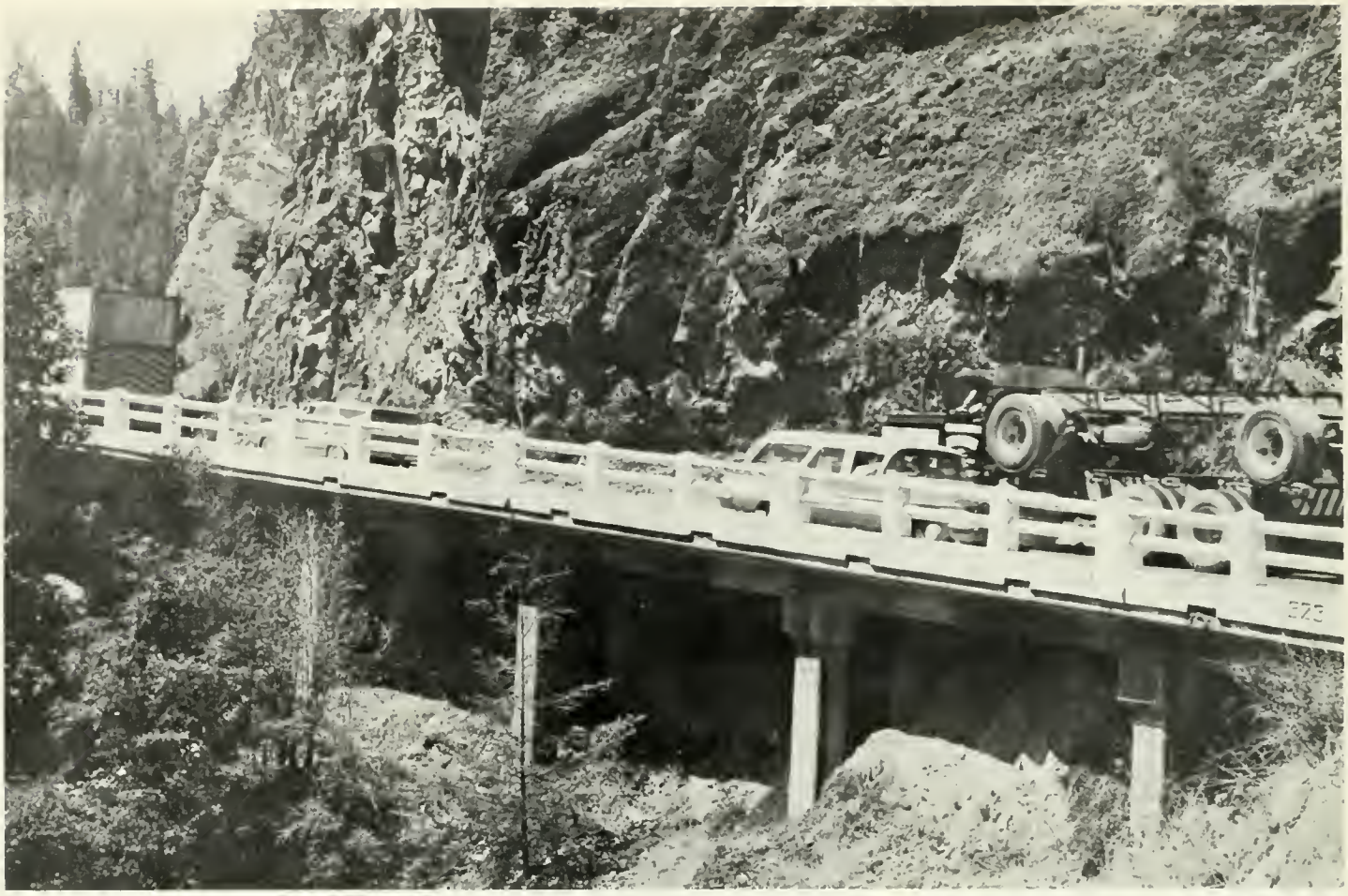
"We Need Roads!"

On the other side of the coin, the Humboldt *Times* was still carrying on the fight for roads in northwestern California. In November 1951, under a 42-point head saying "We need roads!" it pointed out that in the year of 1950 the "tortuous Redwood Highway carried more traffic than multilane Highway 99 to the east of us. Traffic counts so far in 1951 have continued to show large increases."

In 1951 also, the Redwood Empire Association made a direct request to the State Highway Commission asking that US 101 not be located outside the state park boundaries. They said Redwood Empire taxpayers were spending hundreds of thousands of dollars to attract tourists and that the road

. . . Thus leaving the Avenue of the Giants, the former route of 101 just across the Eel River, for the enjoyment of the more leisurely traveler.





Motorists negotiating this narrow viaduct built into the steep terrain in northern Mendocino County can't see the "1923" date on the structure, but it wouldn't surprise them.

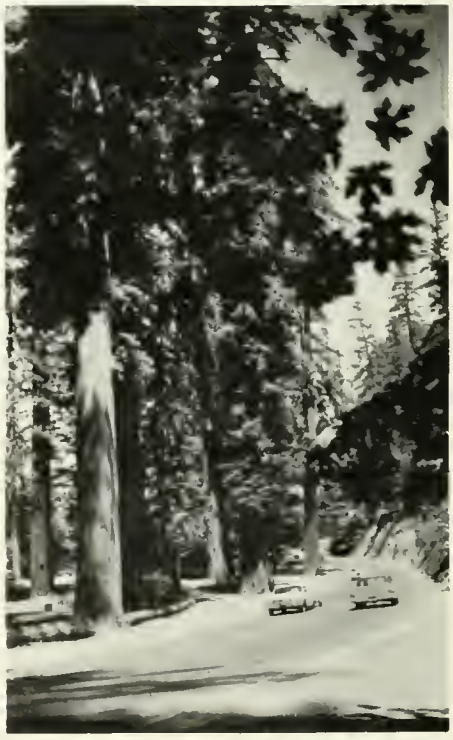
should travel through the redwoods for the benefit of these tourists. At the same time this organization and others were pressing a perfectly understandable desire for safer roads throughout the entire Redwood Empire. Thus the engineering studies had to take into account demands from a dozen directions, in addition to coping with the problems of costs and terrain.

The southern end of the road in Marin County and Sonoma County had received considerable attention and expenditure by the early 1950's. Long sections of the route were already developed into four-lane expressways. Plans were going forward for converting them to full freeways. A number of sections such as the Ridgewood Summit area in the vicinity of Willits needed attention and plans went ahead for design and budgeting of realignment to improve vexing traffic problems. Today the road from the Golden Gate Bridge as far north as Healdsburg is almost all full freeway.

Legislative Attention

In 1953 Assemblyman Frank P. Belotti of Eureka introduced a bill which would give the Division of Highways an easement for a wider, more modern highway through the state park. Several senators from the northwest counties introduced a similar bill in the Senate. These bills aroused conservationists all over the United States and the ensuing publicity resulted in neither of the bills being reported out of committee.

Newton B. Drury, chief of the State Division of Beaches and Parks at that time, said that if the redwoods were "in any other part of the State the inhabitants would be guarding them with rifles." This statement was widely printed.



The highway skirts the Frank and Bessie Smithe Grove (formerly Lone's Redwood Flat) just south of the Mendocino-Humboldt county line.

Eventually a revised bill was passed granting a 25-foot easement.

In the meantime, all through the towns of the Northwest, women's groups, local government groups and taxpayers organizations continued to fight to make the highway safer. The outcome was a decision to remove about 15 large trees in the parks, which allowed the highway to be widened to 25 feet. Prior to this it had been as narrow as 16 feet in some places. Local residents complained there was scarcely room for a school bus and a truck to pass on many sections. One school principal remarked to the Highway Commission that his buses were often late because the drivers were constantly stopping to nail back on the trees the bark that the buses scraped off.

Eventually authorization was given to remove nine trees, for which the State Highway Commission voted $14,000. These were trees less than 12 feet from the centerline of the highway, along a 13-mile section in the Humboldt Redwoods State Park near Dyerville. Of the nine trees approved for removal none were exceptionally large and several were relatively small. The later removal of six more trees was eliminated by redesign of a short section.

"Gratifying Unanimity"

On January 29, 1954, the *Ferndale Enterprise* printed a letter from Mr. Newton B. Drury, Chief of the Division of Beaches and Parks, in which Mr. Drury said "with minor exceptions the State Highway Commission and the State Park Commission achieved gratifying unanimity on three important points. Point 1 was the undesirability of widening the present U.S. 101 through Humboldt Redwood State Park for more than two lane widths (approximately 24 feet). Recognition of this is an important accomplishment.

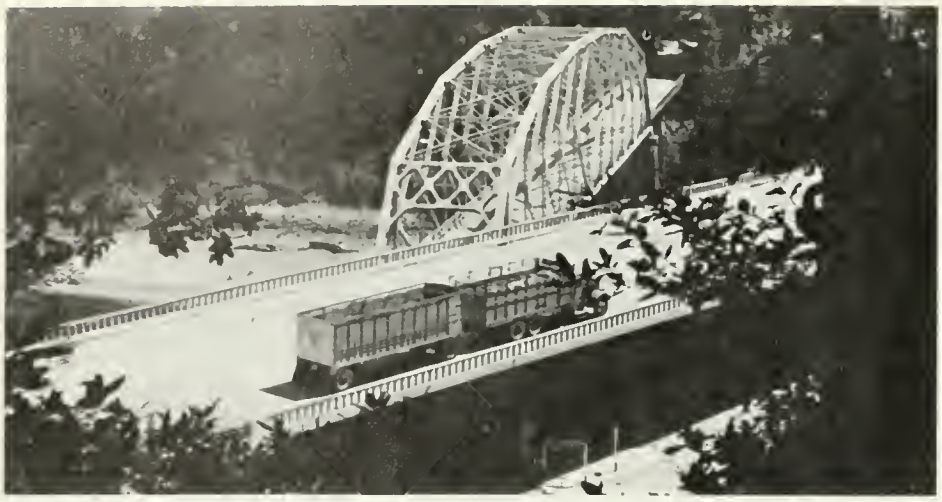
"Point 2, the desirability of a main route bypassing the park redwood groves with ready access to such groves and to connect these along the present route by short side roads; such bypass routes to be suitable for a high standard freeway capable of accommodating future traffic with ease.

"There was some doubt expressed as to the cost of such a new freeway for both construction and maintenance; but we are confident that studies now being carried on will not show such extra cost for the bypass as to justify instead the sacrifice of the redwood parks by plowing a freeway through them.

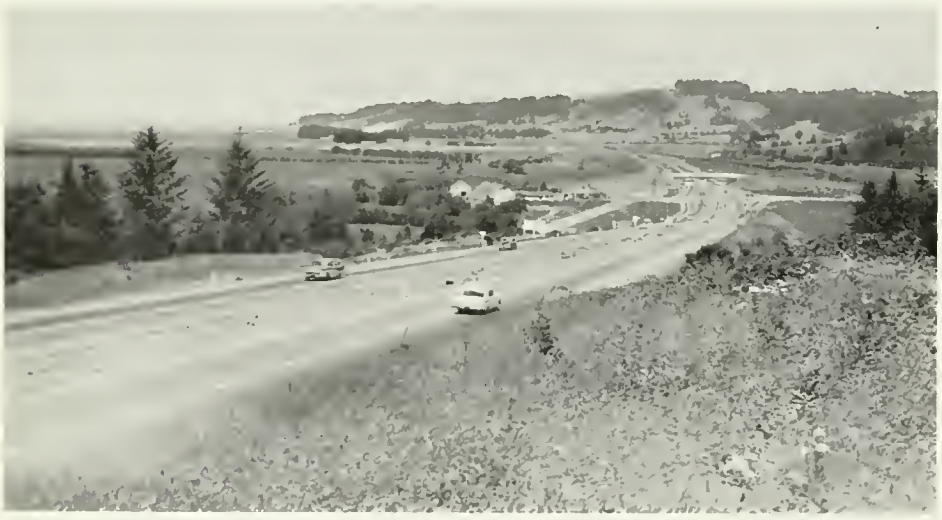
"Point 3, the desirability, when the freeway bypassing the groves is built, of the existing highway becoming a park road, maintained with park funds. It would then serve as a parkway, and be, even more than now, one of the famous scenic and recreation routes in America."

Mr. Drury went on to point out that the Department of Public Works was making a study of several pro-

PHOTO ABOVE—The main street of Willits still does double duty as a through highway and a local traffic and business artery. BELOW—This mountainside section near Garberville, with its typical string of cars, illustrates one type of terrain problem on the Redwood Highway.



The George Leotherwood Memorial Bridge, near the junction of the Eel River and its south fork south of Redcrest, serves through traffic while the old highway bridge now provides access to scenic redwood groves in Humboldt Redwoods State Park.



South of Eureka a section of freeway traverses the plain adjacent to Southern Humboldt Bay.

In a few locations there is a modern 4-lane highway along the ocean front, such as this short section near Wilson Creek in Del Norte County.

posed bypass routes. This proposal did not meet with approval of all concerned but the two agencies were in general agreement as to the future plans of the Redwood Highway through the Humboldt Redwoods and other redwood parks.

Bypass Concept Not Clear

An unfortunate circumstance in the mind of the public as a result of this conference was the supposition that a bypass would entail a wide sweep away from the parks. From an engineering viewpoint the costs involved would have been prohibitive, since the only suitable location for the Redwood Highway is in the South Fork Eel River Canyon. Hence, the road still, in some places, had to go through the edge of groves of redwoods. Despite this, costs were to be much higher and maintenance problems greatly increased by building the road on the sidehills instead of along the flats.

This confusion over the meaning of the word "bypass" was not limited to the conservationists who were trying to preserve the redwoods. The resort owners and other business people of the north coast area who depended on tourist traffic were dead set against the idea of a bypass. They wanted the highway retained as close to the trees as possible so that their value as a tourist attraction would not be lessened. They feared that a high-speed highway would carry the tourists far away from their places of business.

With all these conflicting attitudes, the Division of Highways, in the absence of any clear mandate from the state taxpayers, was reluctant to spend large sums of its funds to build the bypass, and preferred to continue with its studies until the situation was clarified. Assemblyman Belotti, however, was anxious to get the highway improved.

Financing Proposal

In 1955 he introduced a bill which provided that $10,000,000 of State Parks' money from tideland oil royalties could be used to help finance construction of a redwood highway bypass approximately 23 miles long, in the Garberville-Humboldt Redwoods vicinity.

Aerial view of new freeway section just north of Ukiah, looking north along the Russian River valley toward Ridgewood Summit.

The expressway crossing Ridgewood Summit replaced a tortuous bottleneck previously existing between Ukiah and Willits.

In return the Division of Beaches and Parks would get the old highway as a scenic route. No commercial traffic would be allowed on it except as necessary to service those activities within the park and it would be a scenic, slow-speed highway for tourists who wished to leisurely tour through the groves.

Bill Favored in North

Assemblyman Belotti's bill had considerable support from representatives of the north coast counties in the Legislature as well as from many private interests. To the people of the north coast country it represented a speed-up in the solution of their transportation problems. Relative to the discussions, Mr. Drury pointed out that if the bypass plan was not approved, placing the highway through the groves, it "would involve not the death of a few ancient big trees, but rather the wholesale removal of thousands of redwoods, including probably the virtual elimination of smaller groves."

Mr. Belotti's bill passed through the committees and through the Assembly and the Senate but it was vetoed by Governor Knight. The Governor felt the Division of Beaches and Parks did not have an adequate priority system and long-range policy on park projects at that time.

The 23-mile project was not dropped however, and District 1 continued making studies. Comprehensive traffic counts were made.

District Meeting Held

On February 8, 1956, a public meeting was held by the district engineer in Garberville to discuss the "lowline" and the "highline" routes. Approximately 44 miles, running from north of Pepperwood to south of Richardson Grove, were involved. Public opinion was strongly in favor of the lowline route.

At this meeting District Engineer Alan S. Hart said:

"The road will be at the cost of some trees, but most of them are at some distance from the present road, which is intended to be preserved for its scenic beauty which will be unharmed.

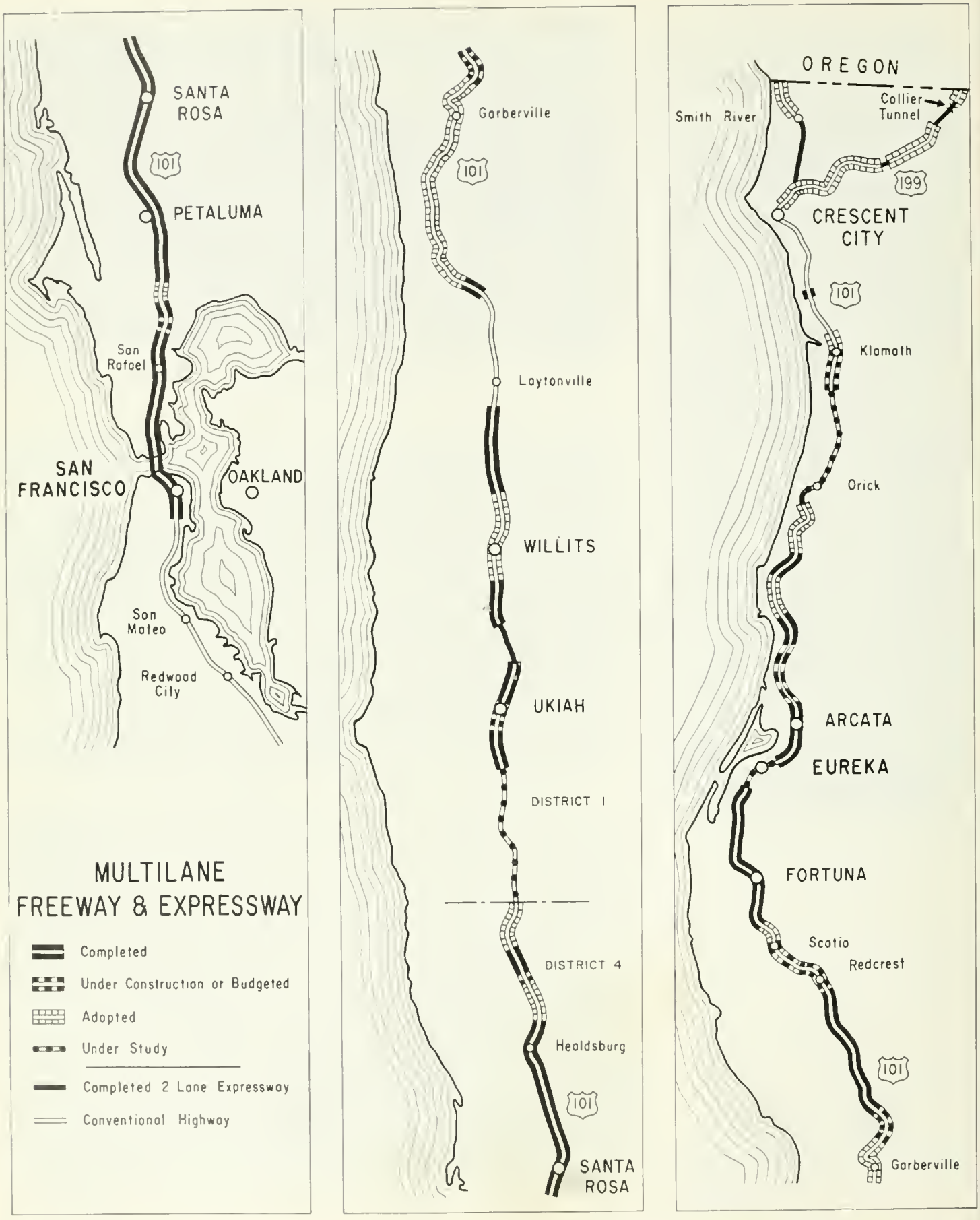
"Between Sylvandale and Myers Flat about 400 'accountable trees' will have to be cut. Most of them are 30 inches or less; a few big ones run to a maximum of 6 feet, but no giants. And none of the trees to be felled are on the redwood flats which are scenically the most valuable" he asserted. "From Weott to Englewood about 2,000 trees are to go, most of them under 30 inches and none over 6 feet in diameter."

Plans for the new bypass were enthusiastically received in some quarters, in other quarters only tacitly agreed to, but there was no strong opposition. The main problem was finding the estimated $36,000,000 needed at that time to build the route. Actual costs today have run much higher.

First Unit Funded

Assemblyman Belotti continued to work on variations to his plan, and finally managed a compromise on financing the first unit of the new route. In 1956, $800,000 was contributed from the State Park Fund for acquisition and construction on the first unit of the Redwood Parks Freeway. Later another $2,605,000 was contributed.

The first freeway stretch was between Dyerville and Englewood, a distance of 4.4 miles. Included was the


SANTA ROSA
101
PETALUMA
San Rafael
SAN FRANCISCO
OAKLAND
San Mateo
Redwood City
MULTILANE FREEWAY & EXPRESSWAY
Completed
Under Construction or Budgeted
Adopted
Under Study
Completed 2 Lane Expressway
Conventional Highway
Garberville
101
Laytonville
WILLITS
UKIAH
DISTRICT 1
DISTRICT 4
Healdsburg
101
SANTA ROSA
OREGON
Smith River
Collier Tunnel
199
CRESCENT CITY
101
Klamath
Orick
ARCATA
EUREKA
FORTUNA
Scotia
Redcrest
101
Garberville

George M. Leatherwood Memorial Bridge, named for a highway engineer who had lost his life that same year in a helicopter accident while on aerial reconnaissance over US Highway 299 east of Blue Lake. (This crossing later was given a national award for steel bridge design.)

The contract was let for the 4.4 miles of construction in February, 1957, at a total construction cost of $6,700,000. This was the beginning of the Redwood Parks Freeway.

As further funds became available additional units have been added to this freeway unit bypassing the redwoods until 22.5 miles are now finished. This includes a new 5.7-mile section from Sylvandale to Maple Hills Road which was opened in October 1964 (see maps herewith).

Old Route Preserved

As the increasing length of freeway has been opened to traffic a long section of the old route has been incorporated into the Humboldt Redwoods State Park, now totaling 24 miles. This is used exclusively by sightseers and tourists. However, subsequent legislation has eliminated the concept of making this a state park highway and it is included now as part of the state highway system. The route is signed "Avenue of the Giants."

Route adoption studies have been completed for all other areas where redwood groves are involved with the exception of Prairie Creek Redwoods State Park and Del Norte Coast Redwoods State Park. These parks are located on US 101 south of Crescent City.

One of these sections, involving Prairie Creek Redwoods State Park, has regrettably become the subject of widespread misunderstanding and controversy during the course of the studies, which are not yet complete.

Problem Solved

Inasmuch as the freeway has been virtually completed through the Humboldt Redwoods area with the practical arrangement of the freeway for through traffic and retention of the "Avenue of the Giants" for sightseers and tourists, this section is no longer controversial. Construction has, except in one or two cases, avoided the groves and either followed the sidehills above the big trees or used the other side of the river, with generous use of bridges.

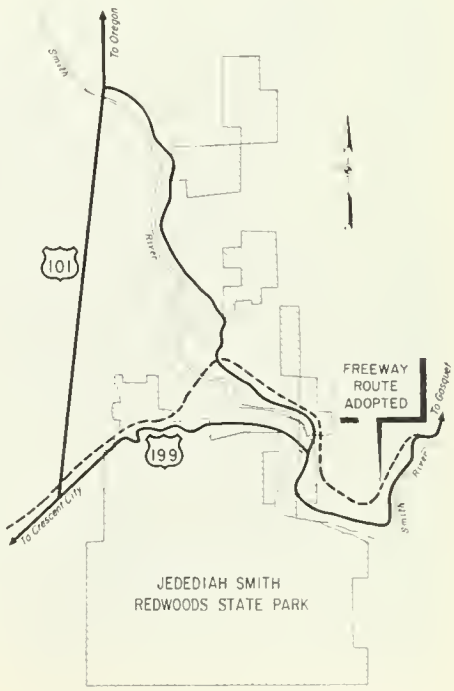
Eagle Point Viaduct, south of Myers Flat, dramatically illustrates an engineering decision which resulted in complete avoidance of a reduced grove.

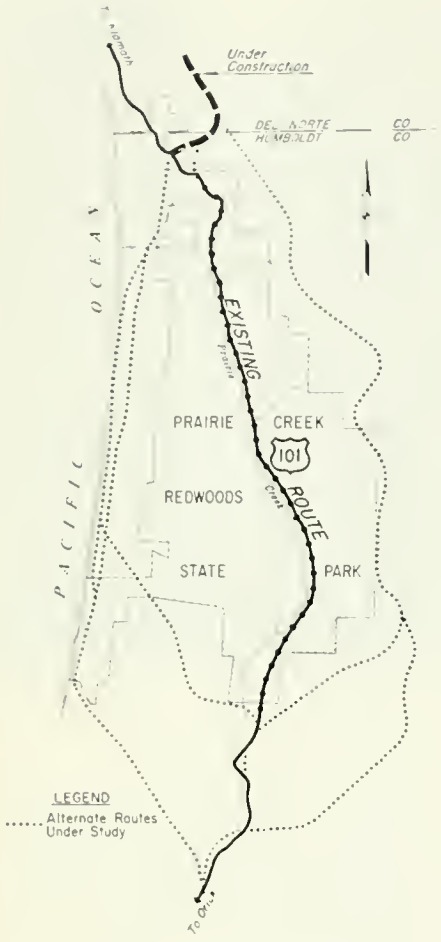
The Eagle Point Viaduct, for instance, south of Myers Flat, had to be built at considerable cost to carry the road on the west side of the river along a very steep slope. Had the engineers been determined to "cut a swath through the redwoods," they could have built this six-mile section at considerably less than its ultimate cost of one million dollars per mile, by following the river flats through the groves. (See page 24.)

There are three redwood parks through which the Redwood Highway passes north of Eureka. These are, from north to south, Jedediah Smith Redwoods State Park, Del Norte Coast Redwoods State Park, and Prairie Creek Redwoods State Park. At Del Norte Coast Redwoods any new alignment most probably will avoid the trees completely. Jedediah Smith and Prairie Creek have been much in the news recently.

Endorsed by Park Officials

Jedediah Smith has had considerable publicity because of reports of a "freeway to be cut through the National Tribute Grove," although the route adopted was agreed to and even endorsed by the State Division of Beaches and Parks. Actually, the route passes from one-third of a mile to one mile north of the north limit of the National Tribute Grove.





The realignment admittedly will take out some redwoods. This is necessary because a section of the park extends northward across *any* feasible route (see map). To avoid this narrow neck of the park completely would cost several millions of dollars additional and take traffic many miles out of direction.

About 40 miles south of Jedediah Smith, approximately halfway between Crescent City and Eureka, is Prairie Creek Redwoods State Park. The selection of a freeway route in the vicinity of this park has had the most publicity, much of it unfavorable to highway engineers who are trying to seek a solution to the problem. The problem is not simple.

Prairie Creek Alternates

Four possible routes for the highway are theoretically under consideration, including the present road which goes through the middle of the park where the Division of Highways owns a wide right-of-way including more than 1,000 fine redwoods within it. Although widening of the existing road through the park would cost several million dollars less to construct, and would provide the best traffic service, it would have the greatest effect on park values and is not being considered for recommendation to the Highway Commission.

Not Through Groves

One of the alternate routes goes along the beach at the base of the bluffs to the west of the park proper. Currently the 3.5 miles of beach required for such a freeway is privately owned, contrary to popular belief, although the Division of Beaches and Parks has indicated it plans to buy this land to add to the park.

Another possibility is a route along the top of the same bluffs. Neither of these routes goes through redwood groves on park land except along the westerly fringe of the park at its very northerly end.

Since the route along the top of the bluffs would require large cuts and fills and would require bridging of several ravines and scenic Fern Canyon, major attention has been focused on the beach route and on an alignment generally east of the park for which a study was requested by the Division of Beaches and Parks.

No "Threat" to Redwoods

The discussions over Prairie Creek are still going on. Just as in 1953, the "threat" to the redwoods has become a *cause célèbre*, interesting thousands of Americans and even individuals in foreign counties. However, contrary to popular belief, the Prairie Creek problem is not a threat to the redwoods. Any location eventually adopted, either to the west along the beach or to the east along the ridge, will require a minor number of smaller trees from the fringes of the park. Governor Edmund G. Brown has stated that any loss of trees to the park from highway construction should be replaced by acquisition, with highway funds, of a like number of privately owned trees. There are thousands of redwood trees on privately owned land immediately adjacent to the park boundaries which can be acquired and added to the park.

The route through Jedediah Smith Park will take only 35 acres, out of this 9,539-acre park. None of the routes under consideration in Prairie Creek would take more than 30 acres of redwoods from this 10,286-acre park. Privately owned trees immediately adjacent to these parks are available as replacement in kind. It is hardly likely any acreage at all will be taken from the undeveloped 5,932 acres of Del Norte Redwoods State Park. It is not probable that in the foreseeable future it will be necessary to consider realignment of any highway in any redwood park except those already discussed.

Conclusion

Summing up the story of the Redwood Highway, these facts are evi-

A driftwood-laden beach and Freshwater Lagoon flank the Redwood Highway south of Orick.

The southern end of the Redwood Highway is the Golden Gate Bridge, shown here with the new visto point in Marin County in foreground and a portion of San Francisco in background.

dent. The terrain through which any route must go is as difficult as there is in the world, and the very rainy winters and unconsolidated materials make highway maintenance almost impossible except when extremely expensive construction techniques are employed.

Because of the difficult terrain and the early dependence upon water transportation, road building in the north coast regions has lagged badly, and the inhabitants of the area have suffered as a result. Although traffic counts are as high or higher on the Redwood Highway than on many other main trunk routes in the State, much of its alignment is still based on surveys 50 years old. Traffic problems are particularly aggravated in the summer months when the logging and vacation traffic reach their peaks simultaneously. The district engineer in Eureka estimates it will cost, at present prices, $340,000,000 to bring to modern standards that portion of the Redwood Highway in his district, namely from the Oregon border to the Mendocino-Sonoma county line.

Travel Time Reduced

Nevertheless, progress is being made. From the results of a study made a few months ago, a San Francisco newspaper reported a short time back that the travel time between San Francisco and Eureka had been cut from eight hours in 1953 to six hours in 1963.

The so-called threat to Jedediah Smith State Park is greatly exaggerated, since the highway is across the river, away from the major portion of the park. Construction has already been completed through the major redwood park, Humboldt Redwoods, creating a safe, high-speed bypass route with the old route preserved as a tourist route. No more routes remain to be adopted except, as noted, at Prairie Creek and Del Norte Redwoods.

The total acreage taken and to be taken for highway through the redwood preserves is on the order of four-tenths of 1 percent of the total redwood preserves owned by the State. Today, these total more than 68,000 acres, many of them undeveloped for public use. More park acreage is still being acquired. In addition, the federal government owns many thousand acres of redwoods, with an additional great acreage owned by private interests.

The few hundred acres taken and to be taken for modernizing the Redwood Highway represent no threat to this great acreage. They do represent tremendous economic advantage to the route's users. More important, the greatly reduced accident rate on the new sections promises escape from crippling injury and death for hundreds of citizens of California as well as our guests from other states and countries.

The northern end of the highway is in the vicinity of the Oregon line, where the Collier Tunnel and its realigned approach (above) has made travel faster and safer between Crescent City and Grants Pass.

Eagle Point

Freeway Construction Requires Bridging of Steep Sidehill

By LOWELL C. ALLEN and OSTAP BENDER, Associate Bridge Engineers

A bold and imaginative routing of the Redwood Park Freeway (US 101) required bridging of a precipitous sidehill area with minimum damage to the natural scenic beauty of existing redwood trees. The Eagle Point Viaduct, near Myers Flat, appears to cling tenaciously to the terrain as it provides the motorist with an unusual view of the redwoods from a vantage point 100 feet above the South Fork of the Eel River.

Usual methods of construction would have required massive excavation for footings and were not practicable in this terrain. The supporting columns were extended approximately 40 feet below ground surface to a foundation in rock.

Uphill foundation shafts were excavated with a rotary drilling rig through the overburden and rock excavation was completed by hand mining. The foundation subcontractor used ½ inch telescoping circular sleeves in 10-foot lengths to shore the drilled holes. Log crib supports for the drilling rigs were used as shown in an accompanying photograph.

Shaft Excavation

Most of the downhill foundation shafts were completely excavated by hand labor mining methods. The excavations were shored with timbers similar to vertical mine shaft operations, and chain link fencing was used to retain material between the timbers.

Excavated material was lifted to the surface by an air driven winch and stockpiled for later removal by clamshell. Trees downhill from the construction were wrapped as protection against stray rocks which escaped the careful stockpiling operations.

The foundation shafts were reinforced and concrete placed against original ground for the entire depth

The Eagle Point Viaduct on US 101 near Myers Flat follows precipitous sidehill terrain praviding the motorist with an unusual view of the redwaads fram a vantage point 100 feet above the South Fork af the Eel River.

The new Eagle Point Vioduct looking southward. The structure wos built with minimum domoge to the naturol scenic beauty of surrounding redwood trees.

Supporting columns for the viaduct were extended approximately 40 feet underground to a foundation in rock.

A rotary drill rig excavates for uphill shafts of the viaduct while supported on log cribbing.

using conventional methods. Equipment operated from the one-lane construction road which had been benched into the sidehill.

The two-column bents vary in height from 25 feet to 60 feet above the ground. The columns are five feet square, solid below ground and hollow above, and the bent cap is five feet wide and six feet deep.

Choice of Girders

Superstructure steel girders were placed with a crane which had to work in the narrow confinement of the construction road. The choice of welded steel girders was made after many studies of different structural types, span lengths, girder depth and girder spacing were completed with the assistance of the electronic computer. For the special conditions at this difficult site the welded girder bridge selected was about 8 percent cheaper than competing types.

Has 11 Spans

The structure consists of 11 spans of 110 feet in addition to shorter slab approach spans and a special retaining wall where the structure slices through a projecting point of the sidehill.

Total cost of the structure was $1,028,000. This represents a cost of $13.10 per square foot of structure and is extremely economical for a structure at this difficult site.

Ball and Simpson were general contractors with Ira Alderson as structure superintendent. P. & Z. Company was foundation subcontractor with Bob Cook as superintendent.

H. W. Benedict was resident engineer for District I. Lowell C. Allen was Bridge Department representative on construction and Ostap Bender design engineer.

SAN DIEGO FREEWAY

The State Department of Public Works has awarded a $6,384,000 contract for constructing 4.2 miles of eight-lane freeway on the San Diego Freeway (Interstate 5) in Rose Canyon on new alignment between 0.1 mile and 4.3 miles north of Balboa Avenue in San Diego.

W-X Street Bridge

By R. N. BRINK, Resident Engineer

The first stage of construction of a new bridge across the Sacramento River started when a $1,148,00 contract for three huge river piers was approved on January 25, 1963. The bridge is located about one mile downstream from the Tower bridge in Sacramento and is a portion of Interstate 80 Freeway which will pass east-west through part of the City of Sacramento between W and X Streets.

Work, Plans Move Ahead on Capital's Freeways

The W-X Street Bridge forms an integral part of the fast-evolving Sacramento freeway system. What is the present status of this system?

First, on Interstate 80 (old U.S. 40), which will pass eastward through the city via the bridge and W-X Street to 29th-30th Street and then north along 29th-30th to connect with the south end of the existing Elvas Freeway.

Work recently started on the superstructure of the bridge includes a mile of freeway approaches at either end from Jefferson Boulevard in Yolo County to Fifth Street in Sacramento. Total cost: $15,000,000.

This section of Interstate 80 including the bridge should be open to traffic by late 1966 or early 1967.

Bids for an interchange in the Westacre Road-Jefferson Boulevard area will be advertised later this year at an estimated cost of $3,000,000.

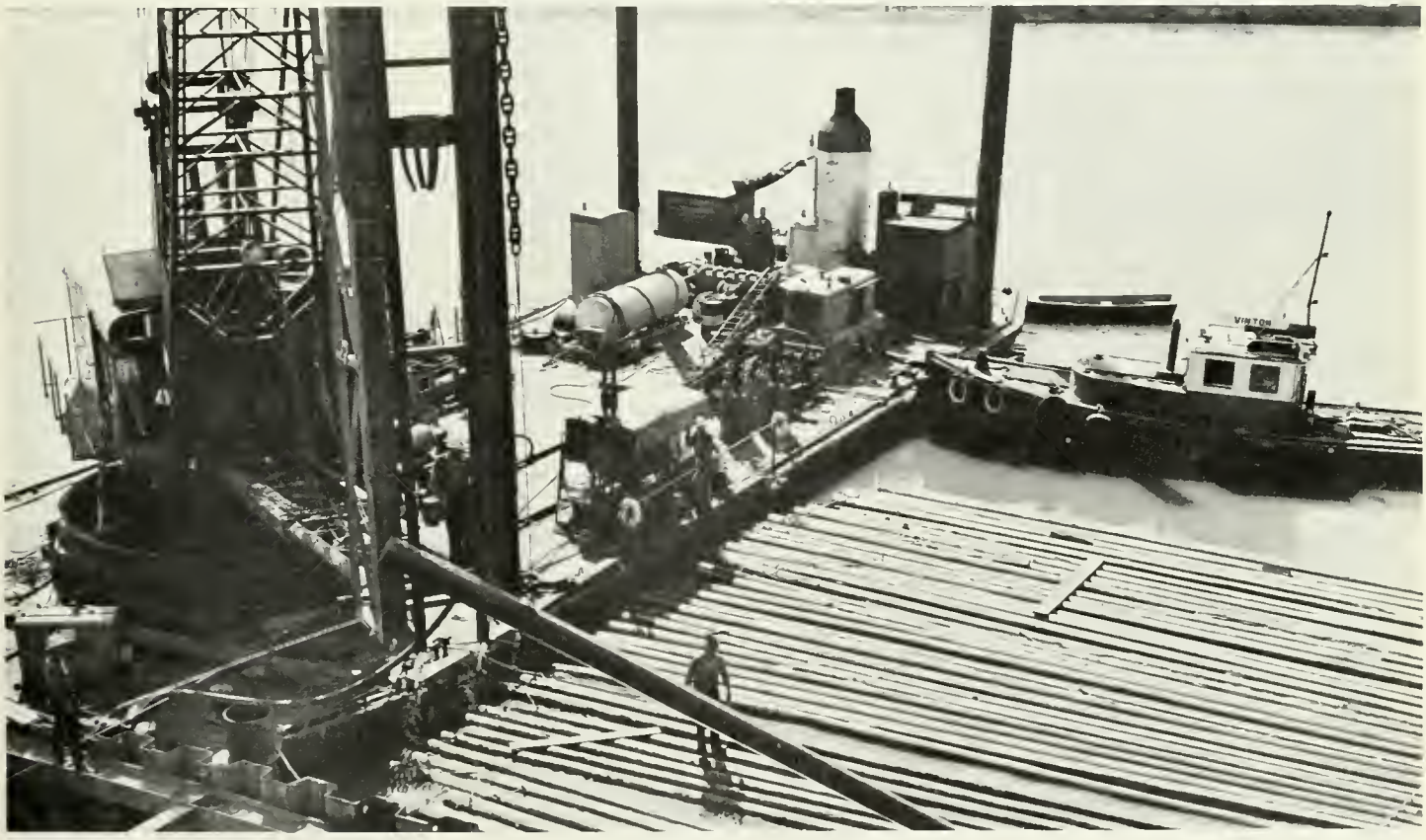
. . . Continued on page 32

Early construction stage at the Yolo County side. Two large derrick barges lower a 64-ton steel waler system inside the sheet pile cofferdam. A raft of timber foundation piles is in the foreground.

PHOTO ABOVE—Final stages of closing the sheet pile cofferdam (Sacramento side of the river). PHOTO BELOW—One of two large derrick barges lowers a 64-ton waler system.

PHOTO ABOVE—An underwater hammer used for driving foundation piles to 35 tons of bearing value per pile. PHOTO BELOW—Driving 50-foot timber piles with underwater hammer.

Pouring tremie seal concrete. Concrete is deposited 20 feet underwater through the tube with the funnel-shaped top. Flow of concrete through the tube is regulated by raising and lowering the entire assembly shown.



One of the 300 timber piles for each pier is hoisted for driving at the pier on the Yolo side of the river.

and connect with US 50 at 29th and 30th Streets.

The completed structure will consist of two fixed parallel bridges which will provide for four lanes of traffic in each direction with no bridge openings to delay highway traffic. Exhaustive preliminary studies were made to determine the vertical clearance necessary for river traffic and the figure which was finally agreed upon by all parties concerned is 55 feet above flood plane. This is the absolute minimum at the haunched portions of girders and will increase to about 59 feet at the center of the main river channel. These figures are based on a flood plane at elevation 31.0; however, the average low water for about eight or nine months of the year is at elevation 5.0, which means that approximately 85 feet maximum vertical clearance will be available to river traffic during low water conditions.

Timber Pile Supports

Each of the three river piers are supported by 300 untreated timber piles. The piles were jetted to a tip elevation of —45 and then driven another 15 to 20 feet to a specified bearing value of 35 tons.

Two different sequences of operation were used in placing cofferdams for the piers. The first, used at Piers No. 1 and No. 3, was to drive the sheet pile, excavate to required depth,

PHOTO ABOVE—Final stages of pier construction. At Pier No. 1 (background) rock riprap is being placed. Center pier is complete except for treated timber sheeting being placed at the near side. At Pier No. 3 (foreground) the fender system is being constructed. Photo by Sacramento Bee. PHOTO BELOW—Looking downstream and across the Sacramento River to Yolo County at the nearly completed substructure of the bridge.

and drive the foundation piles inside the cofferdam. The second method used at the center pier, was to excavate a "glory hole" to required depth, drive foundation piles, and then place a sheet pile cofferdam around the foundation piles. Some drifting of sand and silt into the "glory hole" was experienced before the sheet piles were placed, but it was readily removed with an airlift pump.

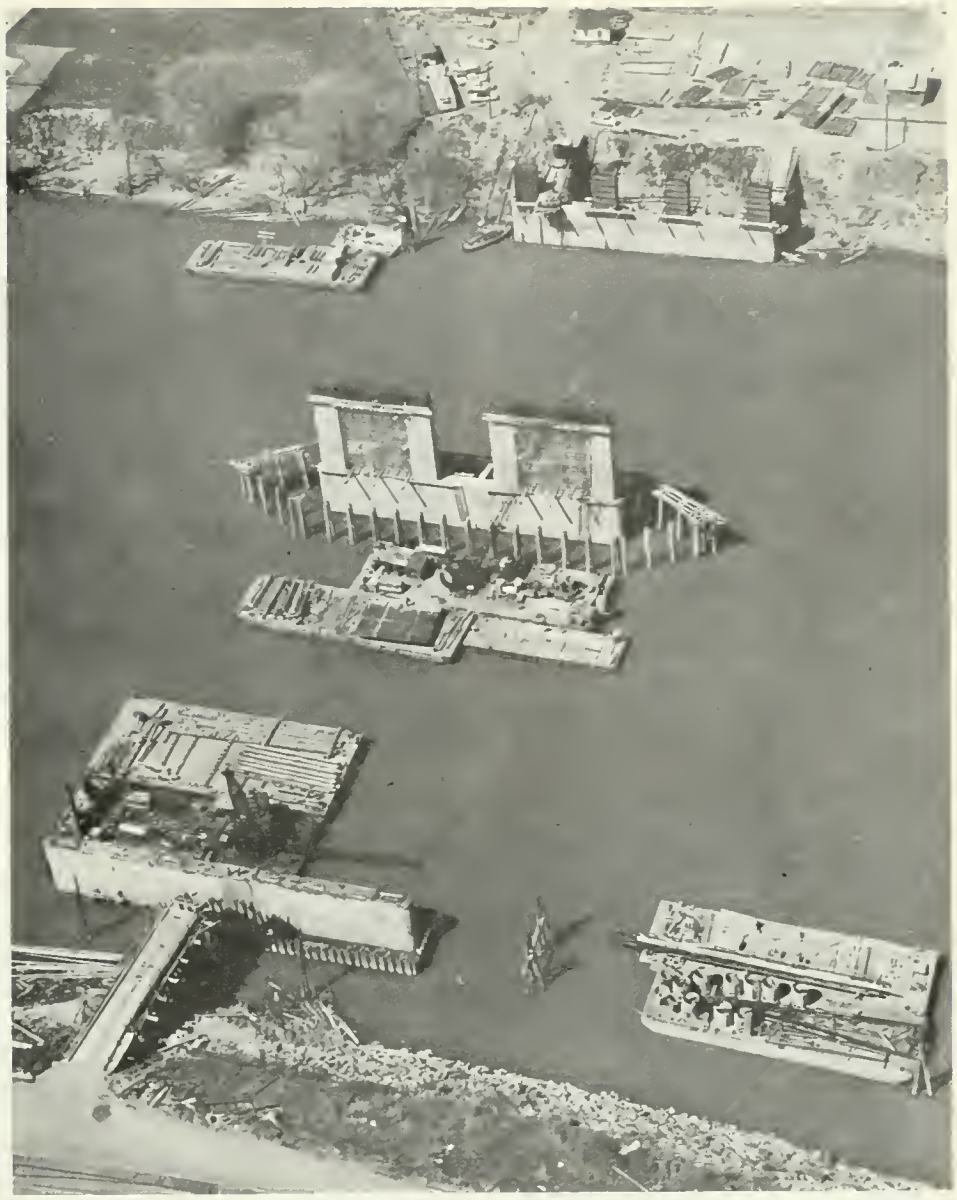
Seal Is Poured

Succeeding operations, in order, consisted of pouring a four-foot tremie seal 23 to 27 feet below water and around the foundation piles, pumping water from inside the cofferdam, and completing the remainder of the work (reinforced concrete footing and pier walls) in the dry. Wet sand mixed with coarse sawdust and small wood shavings proved very successful for sealing leaks in the sheet pile interlocks. One six-inch pump kept the 30′ x 165′ cofferdam dry.

Survey controls were established on dolphin piles driven upstream and downstream from the piers. A tag line was used for positioning the cofferdam frame and sheet piling. Prior to this operation, the tag line (so named because metal tags were attached to the line for pile markers) had been used for establishing excavation limits and exact pile spacing. When the sheet piles were driven to final depth accurate survey controls were then transferred to the steel cofferdam.

Major Items of Work

Major items of work involved in constructing the three river piers consisted of 906 timber piles approximately 50 feet long; 200 precast, prestressed concrete piling 62 feet long; 9,000 cubic yards of class A concrete; 650 tons of reinforcing steel; 110 thousand feet board measure treated timber sheathing; 8,000 tons of rock slope protection; and a navigation lighting system. The work was performed under a joint venture contract by Fruin-Colnon Contracting Company of Burlingame and LeBoeuf Dougherty Contracting Company of Richmond. W. E. DeRousse was superintendent for the contractor and R. N. Brink was resident engineer.



Early stages of pier construction. At Pier No. 1 (background) forms are being started for the column shaft. At Pier No. 2 (center) cap construction is underway and fender work started which involves driving concrete piles. At Pier No. 3 (foreground) the lower section is completed and the sheet pile cofferdam being removed. Photo by Sacramento Bee.

Superstructure Contract

On July 22, 1964, bids were opened for the superstructure contract, which, when completed, will extend from Jefferson Boulevard in West Sacramento to Fifth Street in Sacramento. The successful bidder was Kaiser Steel Company with a bid of $12,700,142.50. P. G. O'Halloran is resident engineer.

This superstructure contract is the largest single unit of highway work to be undertaken in the entire metropolitan area of Sacramento. The extent of the project is reflected in the following major items of work involved:

16,275	cubic yards structure excavation
334,700	linear feet concrete piling (class 1)
4,482	driving piles
54,100	cubic yards class A concrete
13,825,000	pounds bar reinforcing steel
4,360,000	pounds structural steel (A-36)
30,085,000	pounds structural steel (A-441)

The bridge contract will be completed within two years and will alleviate much of the traffic "bottleneck" now being experienced at the Tower bridge entrance to Sacramento.

Work, Plans Move

Continued from page 27 . . .

Construction on Interstate 80 from Fifth Street to 29th-30th Street will start next year.

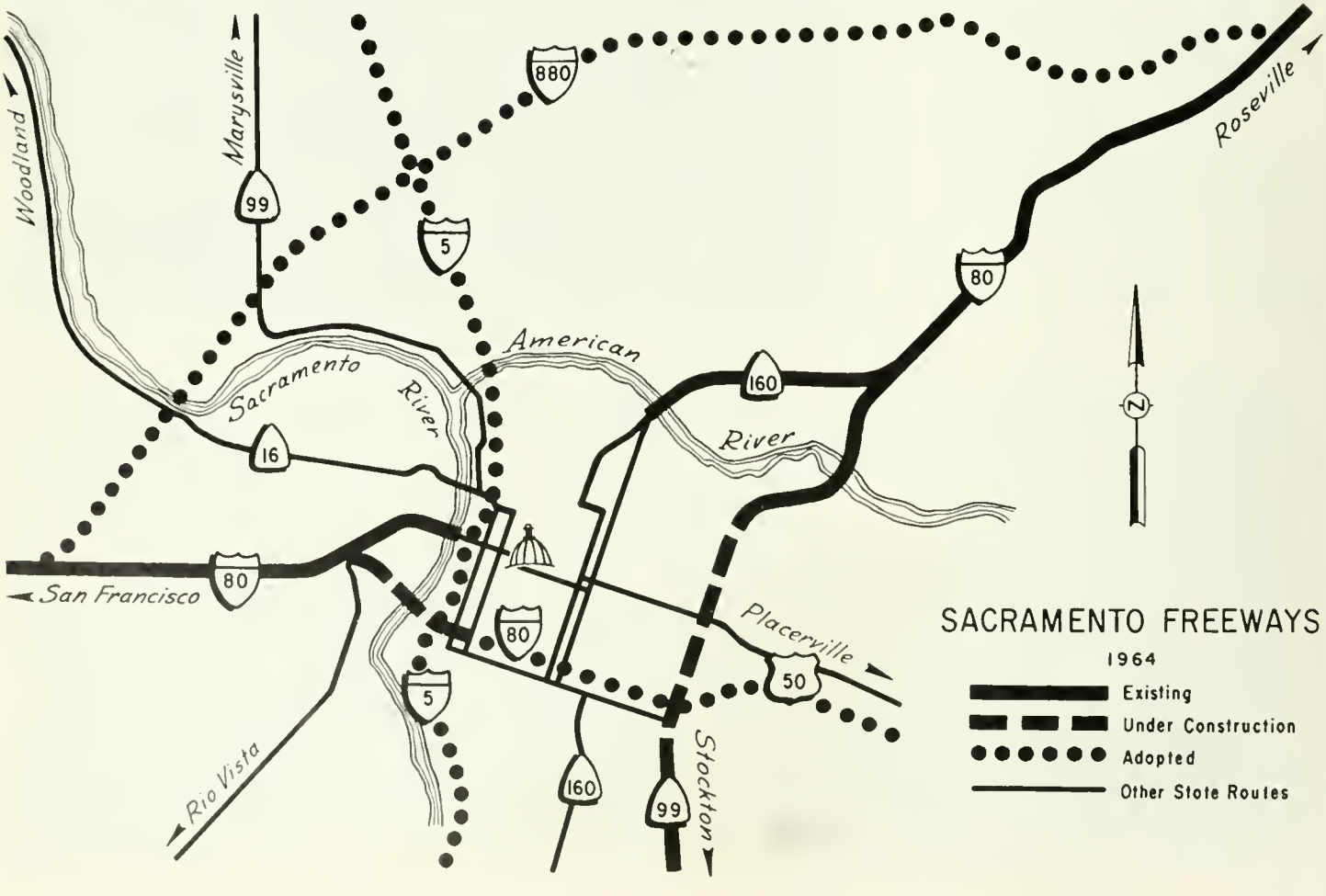
The section between W-X Street and the Elvas Freeway is under construction and will be completed in 1966.

On Interstate 5, which will run north-south through Sacramento in the vicinity of Second and Third Streets:

The north half, from J Street to the American River, is tentatively scheduled for bids in 1966 at a cost of $11,000,000. Construction will take about two years.

The south portion from J Street to Broadway will probably go to bids in 1967. It will cost around $21,000,000 and will take two or three years to build. Construction of a Capitol Mall underpass, which will form part of this unit, will get underway soon at a cost of $1,000,000.

An aerial photo of Sacramento with the freeway routes shown by white lines: W-X Street (Interstate 80) right; 29th-30th Street (Interstate 80 and State Route 99) background; and 2d-3d Street (Interstate 5) foreground.



Interstate 280

Design of New Freeway Stresses Aesthetics

By R. A. HAYLER, Deputy District Engineer

The world's most beautiful freeway!

That's the description the residents of the San Francisco Bay area would like to see applied to the new Interstate Route 280, known locally as the "Junípero Serra" Freeway. And the design engineers of the California Division of Highways are making every effort to oblige them—always keeping in mind the two key words: aesthetics and cooperation. This freeway traverses the foothills of the Peninsula between San Jose and San Francisco.

The conception and design of this freeway has truly been a cooperative effort on the part of all concerned. The bridge and highway design engineers of the Califorina Division of Highways have had the problem of designing aesthetics into the route and still meeting the requirements of geometric and structural standards, reasonable cost, and approval of the local citizens.

The U.S. Bureau of Public Roads, which will administer the expenditure of some 92 percent of the $157,500,000 total cost of this new interstate freeway, has agreed that reasonable additional costs over those normally allowed may be incurred to provide split-level design, independent roadways, and other techniques of aesthetic treatment. Construction costs on this 50 miles of 6-, 8-, and 10-lane freeway will amount to $100,000,000, with the balance going to right-of-way acquisition.

Emphasis on Aesthetics

The increasing emphasis which the Bureau of Public Roads is placing on aesthetics in highway location and design is revealed in a circular memorandum from Federal Highway Adminis-

View looking southwest from Visto Point shows the sporkling waters of Crystol Springs Reservoir and the forested slopes of Cohill Ridge beyond in this ortist's rendition.

Seattle Public Library
NOV 17 1964

trator Rex M. Whitton to engineers of the bureau dated March 1, 1963.

He urged them to "give conscious thought to insuring more than ever the pleasing appearance of our highways. . . . Fit the highway to the landscape—take advantage of the topography, wherever economically feasible, to have separate alignments and profiles for each one-way roadway—streamline the cross sections—use judicious planting for the prevention of soil erosion, the joining of the slopes with roadside native growth, and to possibly act as a buffer for noise and sight control—and design structures, small and large, so that they have architectural excellence." Such miscellaneous structures as walls, fencing, guardrails, and signs should also receive that extra touch of consideration which will add to the appearance of the highway, he said.

"I am sure that with proper attention to all of the other steps in the development of highways that this extra effort in insuring pleasing appearance will add greatly to a highway system of which we can all be proud," concluded Mr. Whitton.

The *Planning Manual* of the California Division of Highways urges the consideration of aesthetic factors in the planning and design process in this manner. "Scenic values must be considered along with safety, utility, economy, and all the other factors considered in planning and design. This is particularly true of the many portions of the state highway system situated in areas of natural beauty. . . . Economy consistent with traffic needs will always be of paramount importance, although a reasonable additional expenditure can be justified to enhance the beauty of the highway itself."

It goes on to mention such aesthetic factors as:

1. Location to preserve the natural environment and lead to and unfold scenic positions.
2. Fitting the general alignment and profile of the highway to the area traversed.
3. Curvilinear alignment.
4. Gently rolling profile.
5. Timber screens.
6. Selective clearing to open up scenic vistas.
7. Wide medians.
8. Independent roadways.
9. Flattened slopes.

"Structures should be located and designed to give the most pleasing appearance, planting should be in harmony with the surroundings, and interchange areas should be graded to provide an expanse of naturalistic easy flowing contours, enhanced by planting cover appropriate to the locality."

Intense Public Interest

The intense interest of the residents of the area in the location of Route 280 has been well demonstrated by the amply attended map displays and public hearings when the route adoption was being considered; many meetings between officials of San Francisco, San Mateo, Santa Clara Counties, the many cities affected and the Division of Highways; correspondence and discussions with such organizations as the California Roadside Council, the California Cycling Association, the Committee for Green Hills, local property owner organizations, and others.

The State Division of Beaches and Parks, the San Mateo County Park and Recreation Commission, the San Mateo County Horsemen's Association, and the Tri-County (San Francisco, San Mateo and Santa Clara) Committee for Freeway Beautification have presented ideas and information concerning their own particular interests in the area.

One group, formed in 1959 specifically to safeguard the preservation of the natural beauty of the area through which the freeway will pass, and to insure appropriate design standards for the Interstate Route 280 (Junípero Serra) Freeway, is named the Peninsula Highway Policy Committee. Composed of representatives of San Mateo, San Francisco and Santa Clara Counties and particularly planning staffs of the counties and the many cities situated in the three counties and also including a representative of Stanford University, it has held many meetings with officials of the Division of Highways in which plans, photographs and models were exhibited and suggestions relating to highway aesthetics were offered.

Varied Terrain

This freeway route, much of which will be built on new alignment along the 50 miles from San Francisco to San Jose, will consist initially of 10-, 8-, and 6-lane sections. It will be built as a 10-lane freeway between the Route 1 and Route 82 freeways in Daly City. Interstate Route 280 will be a full eight-lane freeway from that point southerly to Magdalena Avenue in the vicinity of Los Altos. From there it will be built as a six- (ultimate eight-) lane freeway for the remainder of the route into San Jose.

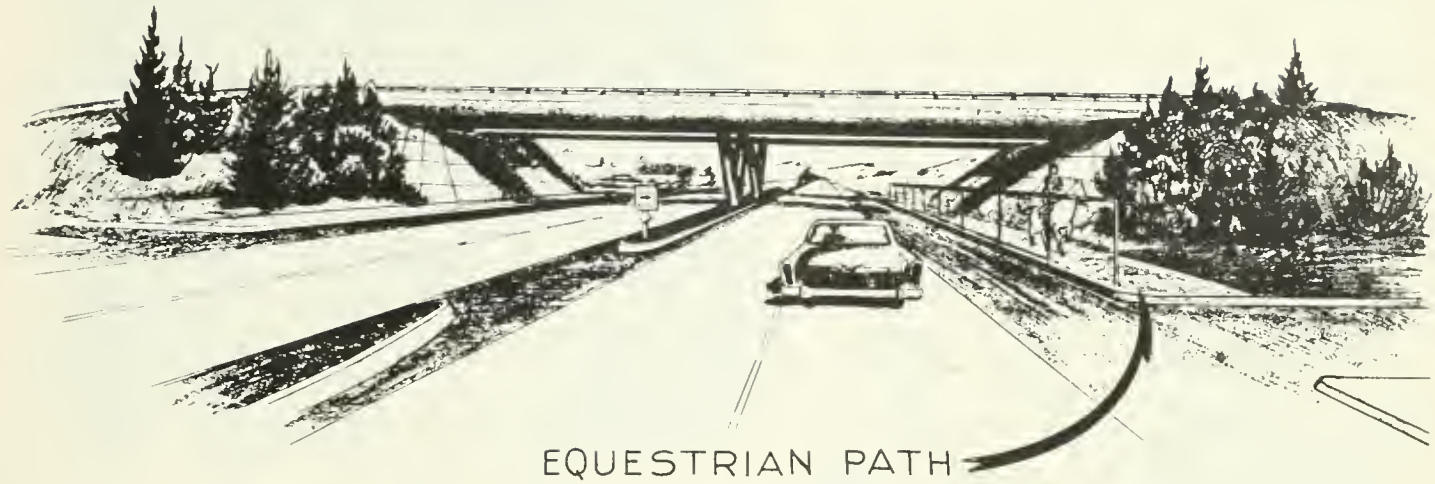
The varied terrain of this new freeway lends itself nicely to aesthetic treatment. Its topography ranges from the rugged ridges and forest-covered slopes of the 14 miles of watershed lands owned by the San Francisco Water Department, along the lovely chain of lakes which make up the Crystal Springs Reservoir, past the gracious estates of Woodside, across 4 miles of gently rolling lands of Stanford University, through beautiful Los Altos Hills, and into the flatter country approaching San Jose.

Construction of this route has already begun. In fact, the first completed portion in San Jose was opened to traffic on March 16, 1964. Other contracts are underway with more coming soon—so soon that the entire 50 miles of freeway are scheduled to be either in operation or under construction in the next five years.

Projected traffic figures for 1975 show that from 50,000 to 150,000 cars each day will be using the new route, with the low figure estimated for the less congested areas away from the metropolitan centers of population and industry. This will offer much needed relief to the Bayshore Freeway, El Camino Real and local roads along the way.

History

Planning for this route started in 1928 when the Counties of San Francisco and San Mateo formed Joint Highway District 10 to develop a four-lane extension of Junípero Serra Boulevard to the south. On July 5, 1956, the Legislature adopted the



A drawing of one of the equestrian paths being provided for horseback riders to cross under the freeway at Robledo Road, Elena Avenue, Magdalena Avenue and Canada Road in Santa Clara County. The paths consist of graded earth to provide better footing for the horses and to preserve the rustic character of the neighborhood.

seven-mile constructed portion of this route as State Highway 237 (now Route 117) and also dissolved Joint Highway District 10.

Meanwhile the Division of Highways, in cooperation with the U.S. Bureau of Public Roads, studied possible routes for inclusion in the National System of Interstate and Defense Highways, which had been authorized by Congress in 1944. The U.S. Commissioner of Public Roads approved the inclusion of a route following the Junípero Serra Boulevard extension in the interstate system on September 15, 1955. The 1957 Legislature added Route 239 (now Interstate Route 280) to the state highway system "from Route 56 (Route 1) near Daly City to Route 2 (Route 82) near San Jose on a route to be selected by the Califorina Highway Commission." The present route was adopted on November 27, 1957, July 23, 1958, and July 20, 1960, after the public hearings and map displays mentioned above.

Cooperation

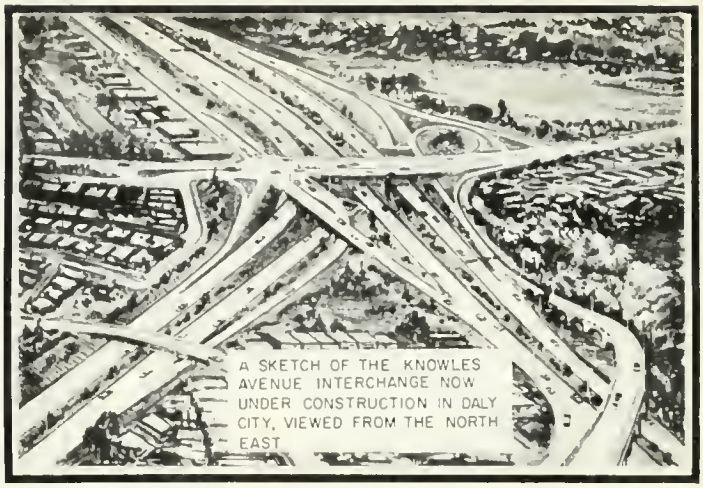
The theme of cooperation runs like a bar of reinforcing steel through the story of the design of Interstate Route 280, tying together the considerations of design standards and reasonable cost requirements on the one side and the aesthetic values and desires of all concerned on the other into a unified whole that will combine beauty and utility into the world's finest freeway. This cooperation includes the agreements arrived at in right-of-way purchase and utility relocations as well as the more formal cooperative and freeway agreements.

One example of how seemingly opposite requirements of two agencies was resolved concerns the new Foothill Junior College location. Soon after route adoption it was discovered that the Foothill Junior College District had chosen the junction of the new freeway and El Monte Avenue for the site of its new two-year college. The freeway neatly bisected the proposed 90-acre site. By minor adjustment in freeway location and college site, a compatible plan was developed and what could have been a major battle was resolved through the splendid cooperation of Dr. Calvin Flint, president of the college, and his efficient staff. As Dr. Flint pointed out, the college required the excellent transportation facilities of the freeway and any minor adjustments in college plan were well justified.

The contributions of various local agencies to the construction of Interstate Route 280 on the sections which have been completed or are currently under construction add up to approximately $1,000,000 to date. The balance of the agreements yet to be negotiated primarily concern the relocation and betterment of storm drains, sanitary sewers, or water facilities. Although utility relocations are normally covered by utility agreements, those areas in which new facilities or betterments to existing facilities are requested become subject to cooperative agreements. By this effort an overall improvement benefiting both local and state agencies is the result.

Design Techniques

The current design of Interstate Route 280 resulted from a complex study of which techniques would best fit the roadway to the contour of the land. Such practices include slope rounding, contour grading, split-level design with the independent roadways varying as much as 70 feet in elevation (in the vicinity of existing Ralston Avenue), variable width median ranging from 22 feet at the San Bruno Avenue grade separation to a maximum of 200 feet at a number of locations along the route, broad sweeping horizontal curves with a minimum radius of 2,000 feet to allow the motorist to enjoy the panoramic views in greater safety, maximum grade of 4 percent throughout the length of the route, and unusual architectural treatment of the more than 70 structures on this freeway to enhance their aesthetic appearance and cause them to blend with the natural beauty of the area which the route traverses.



A SKETCH OF THE KNOWLES AVENUE INTERCHANGE NOW UNDER CONSTRUCTION IN DALY CITY, VIEWED FROM THE NORTH EAST

SKYLINE BOULEVARD PARALLEL SAN ANDREAS LAKE JUST WEST OF MILLBRAE. THE NEW FREEW ROUTING WILL REPLACE SKYLIN THROUGH THIS SCENIC AREA.

SAN FRANCISCO

FRANCISCO CO.
MATEO CO.

SAN
SAN

DALY CITY

SAN BRUNO

SAN

FRA

SAN MATEO

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101

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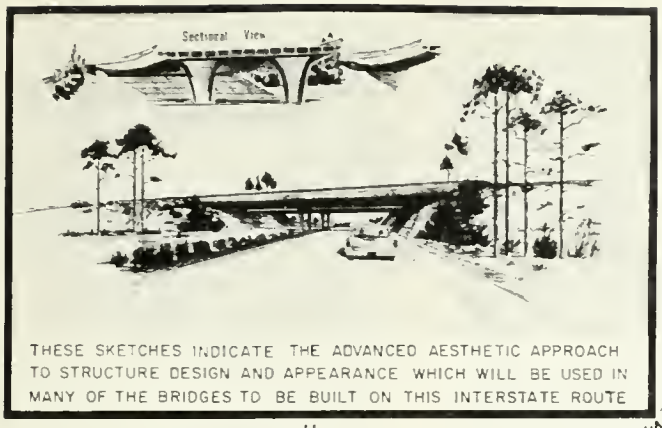
SAN ANDREAS LAKE

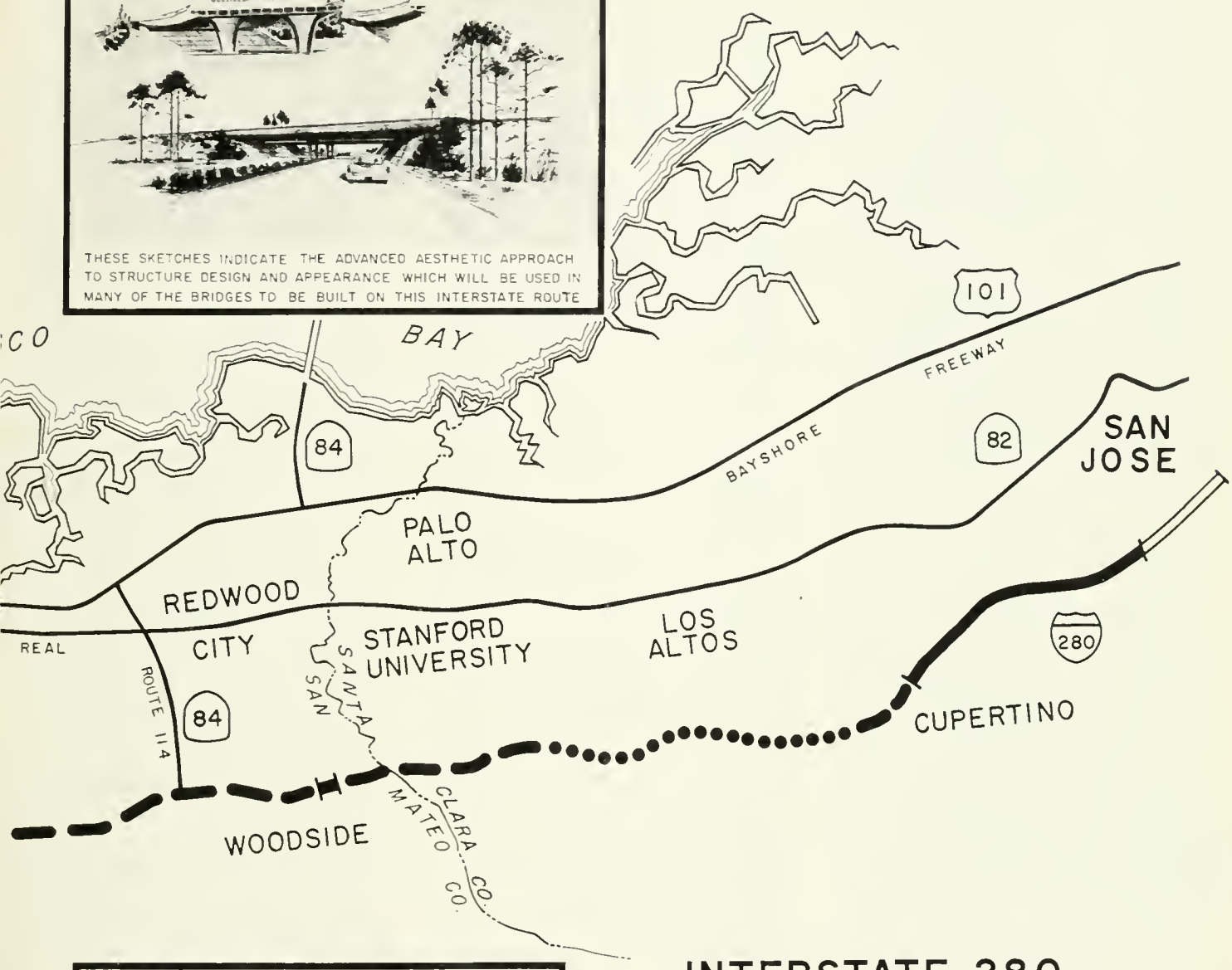
CRYSTAL SPRINGS RESERVOIR

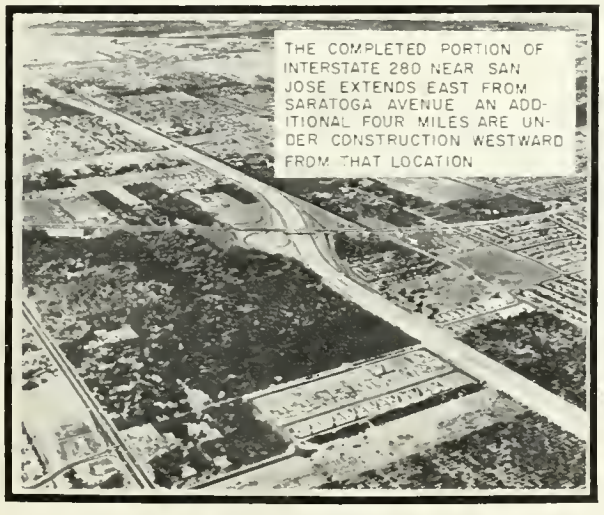
PACIFIC

OCEAN



THESE SKETCHES INDICATE THE ADVANCED AESTHETIC APPROACH TO STRUCTURE DESIGN AND APPEARANCE WHICH WILL BE USED IN MANY OF THE BRIDGES TO BE BUILT ON THIS INTERSTATE ROUTE





THE COMPLETED PORTION OF INTERSTATE 280 NEAR SAN JOSE EXTENDS EAST FROM SARATOGA AVENUE. AN ADDITIONAL FOUR MILES ARE UNDER CONSTRUCTION WESTWARD FROM THAT LOCATION

INTERSTATE 280 STATUS

LEGEND

COMPLETED

UNDER CONSTRUCTION

BUDGETED

DESIGN

Structures

After spending considerable time with the noted San Francisco architect Mario J. Ciampi, the Bridge Department designers came up with a new look for the structures on this freeway. Some aspects of his proposed treatment are combined with economic structural requirements to produce such new and pleasing features as curved edges on the bridge and superstructure to create the illusion of thinness, variety in form and appearance of the supporting piers, extension of the bridge railing to eliminate the need for metal guard railing at the bridge ends, and liberal use of curved and oblique surfaces to soften the lines, reducing the visual impact of the concrete structures and thus blending into the surrounding area. Those structures which cross over the freeway will be prestressed to reduce the thickness of the overhead structure and provide a thinner, more pleasing profile.

San Mateo Creek Bridge

The most impressive structure on the entire length of Interstate Route 280 will be the bridge over San Mateo Creek in Hillsborough. More than 1,600 feet long and soaring 270 feet above the creekbed below, the bridge will have a five-span welded steel girder superstructure resting on four concrete piers consisting of bents with tapered legs meeting at the top in a graceful arch. The twin roadways will be connected by a solid slab in the middle with a 22-foot division area, concrete barrier rails at the outer edges, and a concrete barrier in the division area with expanded aluminum glare shield.

There has been a conscious design of shadow lines in the entire structure by Bridge Department designers, who realized that the adjacent area is one of the more attractive parts of the Peninsula and devoted a great deal of study to it. This structure will complement its surroundings, be a credit to the adjacent community, and a source of pride to its builders. It will be visible from many angles because of its closeness to the parking area at Crystal Springs Dam and its location above the winding Crystal Springs Road.

Scenic Highway

The beauty of the area in which the San Mateo Creek Bridge will be located has been recognized by the State Legislature. It has included that section of Interstate Route 280 overlooking the chain of lakes in the San Francisco Water Department watershed lands area as part of the California scenic highway system.

The concept of a scenic highway system in California has been under consideration since 1960, when the Legislature asked the Departments of Public Works, Water Resources, and Natural Resources, and the State Office of Planning to collaborate on an investigation and prepare a report and recommendations for a statewide system of scenic highways. The 1961 session authorized appointment of a seven-member committee to consist of officials of counties and cities, of persons having special competence in the fields of landscape architecture as it relates to scenic conservation, and others interested in highway, land planning, and park problems to act in an advisory capacity to this investigation.

This report was considered at the 1963 session of the Legislature, which adopted a system including some 4,900 miles of state highway routes as state scenic highways. The writers of the report defined a scenic highway as having the following attributes:

> It is a portion of the state highway system, it traverses areas of outstanding scenic beauty, and its location, design, and construction receive special attention in terms of impact on the landscape and in terms of visual appearance.
>
> It is the intent of the Legislature in designating certain portions of the state highway system as state scenic highways to establish the State's responsibility for the protection and enhancement of California's natural scenic beauty by identifying those portions of the state highway system which, together with the adjacent scenic corridors, require special scenic conservation treatment.

Vista Point

In order to give motorists a chance to stop and enjoy this spectacular view at their leisure, a vista point will be built a half-mile north of Crystal Springs Road in San Mateo westerly of the Hillsborough town limits. Northbound travelers will be able to get a bird's eye view of the Crystal Springs lakes, the tree-covered slopes of Cahill Ridge to the west, the impressive San Mateo Creek Bridge to the south, and the eight lanes of the "Junípero Serra" Freeway, divided by a 200-foot-wide median in this area, some 60 feet below this vantage point.

Just above the adjacent freeway, an oasis for weary travelers will provide fresh water, picnic tables, and sanitary facilities in a full-fledged rest stop, which will be contour graded to blend into the background and planted with trees to provide shade and enhance the area. A pedestrian ramp with decorative handrail will lead up from the rest stop to the vista point.

Hiking, Horseback Riding

Residents of both San Mateo and Santa Clara Counties expressed concern about the availability of access to foothill areas, after the freeway is built, for such recreational activities as hiking and horseback riding.

In San Mateo County, assurance has been given to the county park and recreation department, the county hiking and trails committee and other organizations that 13 of the vehicular over- and undercrossings between Crestmoor Drive in San Bruno and the Santa Clara county line will include from 7 to 10 feet of additional space for the use of nonvehicular traffic.

Ten of the separation structures in Santa Clara County will also include space for nonvehicular traffic. At three of these crossings, plus one near Woodside in San Mateo County, for the benefit and safety of both the motorist and the horseback rider, there will be separate graded earth paths provided for equestrian use. These crossings will preserve existing bridle path routes which are extensively used.

Overall Design

Because of the size of the job, the design has been divided among Assistant District Engineers M. E. Hardin, J. C. Black, and W. P. Smith, with Design Engineers Barney Camp-

bell, Bart Berger, Drury Elder, E. J. Stewart, and E. A. Jones supervising the project engineers of the individual units.

The design of all bridge structures on the route was supervised by A. L. Elliott, Bridge Engineer—Planning, of Headquarters Bridge Department. Senior Bridge Engineer Bob Cassano was in charge of the structure design, and Bridge Architectural Senior Warren S. Ludlow of the Bridge Department's Architectural Section was instrumental in the finalization of the aesthetic design which will be used.

The Division of Highways makes every effort to provide a balance of earthwork while seeking to avoid long hauls. By hauling excavation from one spot to a fill on the same or an adjacent project the earthwork is in balance and an economical job results. That is essentially the situation on the entire length of the "Junípero Serra" Freeway project.

The 50-mile length of Interstate Route 280 has been separated into 15 units for project purposes. This article will discuss specific features in order from north (San Francisco) to south (San Jose). Since project limits are described by readily identifiable street names or landmarks for the benefit of the general reader, there is considerable overlapping of the areas discussed and more than one project is discussed at a time.

Daly City to County Line

This entire job now under construction is essentially a mile-long 6,000-foot) interchange of 10- (ultimately 12-) lanes running southerly from the three-level Knowles Avenue Interchange, where Route 1 will lead traffic from the southwesterly part of San Francisco into the Junípero Serra Freeway, to 1,500 feet south of Eastmoor Avenue, where Route 1 will leave Route 280 in a westerly direction. The bottom level of the Knowles Avenue Interchange is a 700-foot-long cut and cover tunnel with box girder construction on the top slab. It will funnel southbound traffic from Route 1 into Interstate Route 280.

Right-of-way acquisition in this area included some 11 acres formely a part of the Lake Merced Golf and Country Club. Extensive negotiations took place before a settlement was reached. Work is now in progress to reestablish the course to the same standards and length it formerly possessed, including rearrangement of the entire course, filling of a deep gulch at the northerly end of the property, and construction of new club and caddy houses. Play will be restricted to nine holes during the construction period.

South San Francisco to Daly City

Design on this unit was delayed for some time while studies were made of alternate interchange plans affecting adjoining subdivisions. Although big cuts (200 feet maximum) and fills (120 feet maximum) will be made during the freeway construction, the owners will cooperate in grading their lands to match the freeway construction, thus conserving property and providing more economical use for both subdivision and freeway. Regional shopping centers are envisioned by the subdividers at Westborough Boulevard and Serramonte in Daly City.

Although none of the cemeteries in Colma or Daly City will be affected by the new Interstate Route 280 freeway, work is now in progress on the relocation of the Chinese Cemetery Road to a bench on the Route 1 freeway right-of-way in order to continue cemetery access after freeway completion. Before the relocation work could begin, however, a problem had to be solved. The Chinese believe it improper to carry the remains of their deceased through the back gate of a cemetery. Grading operations for the Serramonte subdivision had cut off the cemetery's front gate access road to the west and the Route 1 construction threatened the access road to the east. The only solution was for the subdivider to construct a temporary access road to the main gate from Skyline Boulevard at no charge to the cemetery association, to serve the cemetery until relocation of the regular road is finished.

Drawing of a section of Interstate 280 (looking north) showing the split-level independent roadways for each direction of travel passing through scenic vistas surrounding the Crystal Springs Reservoir. The area shown above is just south of the site of the future San Mateo Creek Bridge.

The Route 280 freeway will cut through the southwesterly tip of the Serra Vista School property in South San Francisco. However, since the freeway will be depressed in this area, it will not be readily visible nor audible from the school buildings.

San Bruno to South San Francisco

The outstanding feature of this section will be the four-level interchange located between San Bruno Avenue and Sneath Lane where the future Route 186 will provide a cross-county, east-west lateral traffic artery. The lowest level, the branch connection that will carry northbound traffic on Route 280 easterly to Route 186, will be 30 feet below ground level. This structure, to be of box girder design with rounded ends, will present a pleasing picture.

Although the overall design of Interstate Route 280 will avoid the use of retaining walls as much as possible, consideration is being given to their aesthetic apperance where they are used. Studies are being made of one 1,200-foot section between Sneath Lane and Valleywood Drive where it is proposed to place step retaining walls from 6 to 12 feet apart with planting between. One wall will remain a constant 6 feet in height while the other will vary from 0 to 6 feet.

Hillsborough to San Bruno

The chain of lakes that store the water supply of the City of San Francisco begins near the northerly end of this part of Interstate Route 280. As increasing turbidity of the water and protection of the lakes from pollution has been a matter of concern to the city water department for some time, it has been decided that a new filtration plant will be built at Crystal Springs Road in San Bruno. Grading for the freeway in this area will include preliminary grading for the plant site. An undercrossing will be provided to connect the new plant with the water department work area at Crystal Springs Lake and a continuous service road will be constructed on the westerly side of the new freeway from the vicinity of Larkspur Drive in Millbrae to the Crystal Springs Golf Course. Access to the service road will be provided at all interchanges.

Another design problem is that of control of drainage from the new freeway slopes during and immediately after construction. Several pumping plants will be provided in a dual drainage system on the westerly side of the freeway to divert turbid water to the easterly slopes, away from the lakes. Clean water will drain down into the lakes.

The old Junípero Serra Boulevard, which the new freeway follows, ends in this area and the new route swings in a southwesterly direction roughly paralleling Crystal Springs Road in San Bruno to join Skyline Boulevard (Route 35) heading south.

The section of the new Route 280 from Millbrae to Woodside overlooking the watershed is one of rare scenic beauty. Motorists in this vicinity will be able to enjoy panoramic views of the lakes and the forested hills behind them from both of the independent roadways, separated by a median varying in width up to 200 feet. Skyline Boulevard between Trousdale Drive and Millbrae Avenue will be superseded by Route 280 after the new freeway is completed.

Woodside to Hillsborough

The four units included in this section encompass some of the most breathtaking vistas to be seen along the entire "Junípero Serra" Freeway route, which follows a path generally easterly of Skyline Boulevard in this area and will permit motorists to enjoy the pleasing panoramas of the verdant greens of the Crystal Springs Golf Course, the sparkling lakes below, and the deeper green of the mountains in the distance to the west. Northbound travelers may pause at the combination vista point-rest stop, refresh themselves, and enjoy the view at their leisure. The vista point and the San Mateo Creek Bridge have been described earlier in this article.

After long negotiations with the San Francisco Water Department, which owns the property, some 10 acres of the Crystal Springs Golf Course were acquired by our right-of-way agents. While only three holes will be directly affected by the freeway, it will be necessary to revise the entire first nine and reconstruct the 15th green and the 16th tee. Because of the topography of the land and because the slope is from the freeway to the reservoir, the fairways, tees, and greens must be laid out carefully to minimize the possibility of turbid water draining down into the reservoir. The entire irrigation system must also be revised. A golf course architect has been employed to supervise the necessary course revision.

The work, which is now in progress by the City of San Francisco and which will be paid for by the Division of Highways, is scheduled for completion by June 1, 1965. The division will also build an entrance road to the golf course from the new Black Mountain Road Interchange and is working closely with water department officials to avoid disruption of the landscape and minimize the taking of trees.

This section also includes connections to two cross-county state highway laterals—the Route 92/280 Interchange at Ralston Avenue and the Route 114/280 Interchange at Woodside Road.

A private service road for the watershed area will be built from Ralston Avenue south to the city limits of Woodside with access at all interchanges, roughly parallel to the new freeway. Northerly of Ralston, portions of Skyline Boulevard will also provide access to the watershed area.

The future southern site of the College of San Mateo is located easterly of the freeway between the future Farm Hill Boulevard extension and Godetia Drive. The campus of the proposed new Sequoia Union High School District site in Redwood City will be located nearby on the northerly side of the Farm Hill Boulevard extension. The Division of Highways is cooperating with the school authorities by providing proposed freeway grading and alignment plans for use by their architect and engineer. The interchange at Farm Hill Boulevard will serve both college and high school traffic, as well as the anticipated increased population of the area.

Woodside Road to Cupertino

This section of Interstate Route 280 winds through the lands of Stanford University and continues southerly

through the beautiful Los Altos Hills area, presenting more enchanting views to the motorist.

The 272-foot-long bridge that will carry freeway traffic over the linear accelerator is under construction on Stanford University property. Designed to harmonize with the linear accelerator buildings, it will have a steel girder superstructure and circular supporting columns. Due to be completed in March 1965, it is being built ahead of the adjacent freeway sections so that its construction can be coordinated with the construction of the linear accelerator by the Atomic Energy Commission.

The pilot studies for aesthetic design of the freeway bridge structures were conducted on structures proposed in the Los Altos Hills section of the freeway. Models and sketches of bridge structures proposed at Mora Drive, St. Joseph Avenue, El Monte Avenue and Magdalena Avenue were shown to various committees and received widespread publicity in newspapers throughout the San Francisco Bay area. The resulting public acclaim encouraged the adoption of this design for most of the bridge structures on Interstate Route 280.

Cupertino to San Jose

The newly constructed portion of Interstate Route 280 joins State Route 17 in San Jose. Design of the section within the limits set above involved many intricate problems which required long and involved negotiations with the governmental units and groups concerned before they could be solved satisfactorily.

Design for the freeway in the Los Altos-Cupertino area was held up for approximately two years pending a decision on proposed abandonment of a branch line of the Southern Pacific Railroad. Abandonment approval by the Interstate Commerce Commission was recently affirmed, which will allow construction by Santa Clara County of its Foothill Expressway following the former railroad right-of-way. With this decision, and removal of the rails, the State is now completing its freeway plans in the area based on this new set of facts.

The division plans to relocate the Permanente Spur (serving the Kaiser Permanente Cement Plant) to parallel the new freeway. Santa Clara County plans to use the railroad right-of-way easterly of Route 280 for its new Foothill Expressway. By terms of a cooperative agreement with the county, the division will build portions of the Foothill Expressway at the Foothill-Route 280 Interchange.

Another knotty design problem is that of providing access to the facilities of the California Water Service Company, the Maryknoll Seminary, and the property of the Roman Catholic Archbishop of San Francisco since access would have been blocked by the freeway and the SPRR Permanente Spur. It will be solved by construction of a combination public-private road designed to provide access to both existing and relocated water tanks, Maryknoll Seminary, and the Catholic lands, on which development of a golf course and cemetery are planned. The private portion of the service road will extend from the vicinity of Arboretum Road to Maryknoll Road and will serve the Maryknoll Seminary only. The railroad service road crossing will be at separated grades.

Several cooperative agreements were reached in this area. In one, the division bought the right-of-way and agreed to build the Junípero Serra channel from Stelling Road to Calabazas Creek on a 50/50 basis, for which the Santa Clara County Flood Control and Water District will pay an estimated $275,000. Another agreement was reached where Route 280 is located adjacent and approximately parallel to Moorpark Avenue, a two-lane city street. The Division of Highways purchased the right-of-way to widen Moorpark Avenue to a four-lane street from Winchester Road to Saratoga Avenue. The City of San Jose will build the street, which will serve as a frontage road.

The section of Interstate Route 280 between Saratoga Avenue and Stelling Road, now being constructed, is scheduled for completion in March 1965.

The most southerly section of the new freeway, from Forest Avenue in San Jose to Saratoga Avenue, was opened to traffic on March 16, 1964. A major construction feature of the work was the modification of the full cloverleaf interchange on the existing freeway at Stevens Creek Boulevard to accommodate collector roads and direct freeway-to-freeway connections.

Erosion control will be included as part of each construction contract on this entire route. In addition, it is generally proposed in Santa Clara County northerly of Route 237 and in the San Mateo County contracts to include 10-foot iceplant borders on each side of the freeway shoulders, with the remainder of the cut and fill slopes to be planted with inoculated seed of strawberry clover.

Landscaping is planned to begin during the next planting season after each construction contract is completed. Plans for landscaping the first completed portion of the route, from Forest Avenue to Saratoga Avenue, have been prepared, $250,000 has been budgeted, and it is anticipated that the work will be well along by the time this article appears. Plans are now being prepared for landscaping that portion of the route now under construction between Saratoga Avenue and Saratoga-Sunnyvale Road.

And this is the design story of Interstate Route 280, the "Junípero Serra" Freeway, the freeway that will traverse some 50 miles of the most beautiful countryside in California.

The route's broad curves and gently rolling profile will unfold new scenic delights to the eye of the motorist from the rugged ridges and forested slopes, past the lakes and through the foothills of Santa Clara County. The split-level, variable-width-median design of the freeway and the new architectural features of the more than 70 structures will add to the enjoyment of the motorist.

With construction underway from San Francisco south and San Jose north, many new contracts wil be let during the next few years. The final work in the vicinity of the San Mateo-Santa Clara county line should be completed or under construction within five years. This new freeway will afford much needed relief for traffic using the heavily congested Bayshore Freeway and El Camino Real, and, undoubtedly, will change the driving—and even the living habits—of many Peninsulans.

Freeway Leaflets

Boy Scouts Help Distribute Them

The far-reaching impact of freeway development in the State of California has nowhere been more universally felt than in District VII—Ventura, Los Angeles and Orange Counties—where annual expenditures for right-of-way and construction amount to $200 million. As the projected 1,500-mile freeway-expressway system gains headway—it is now almost one-third complete—distant cities and communities are being linked together in an integrated transportation network, promising motorists greater mobility, travel time and distance savings.

Affects Many People

A public works undertaking of this magnitude affects a large cross-section of the people, and particularly those who reside immediately adjacent to freeway construction projects. It is with these residents that most questions arise: *When will the freeway be completed? Where will the interchanges be? What's the cost of the job and who's in charge of it?*

In order to answer these questions and others, District VII of the State Division of Highways in January 1964 embarked on a new public information program designed to bring the freeway directly to the people. The pilot project was the starting contract on the Pomona Freeway in East Los Angeles. A package handout, containing a letter from the resident engineer, a job fact sheet and engineering map, was prepared by the Press and Public Information Office and distributed by engineering personnel to tenants and home owners along the construction site.

Mrs. Massengale of 20307 Roseton, Lakewood, was the first recipient of the leaflets distributed by Scouts (left to right) David Hunt, Jerry Zappa and Michael Moore.

Public Reaction Good

Public reaction was instantaneous and enthusiastic, and on this basis the district decided to continue this information program on all jobs of a million dollars or more. The original handout was streamlined into a single, convenient, illustrated leaflet, which could be kept as a permanent reference during the course of construction. This new leaflet was distributed house-to-house by state engineering personnel and contractors' crews, on portions of the San Gabriel River Freeway (Interstate 605), the Santa Monica Freeway (Interstate 10), the

Ventura Freeway (US 101) and the Garden Grove Freeway (Route 22).

Seek Boy Scout Aid

It was at this time that Edward T. Telford, District Engineer, sought out the aid of the Boy Scouts of America, both from the standpoint of freeing field personnel for engineering duties and of providing an opportunity for the Scouts to work in the public service.

In a letter to Walter R. Whidden, Regional Executive, Boy Scouts of America, he wrote: "Our problem at this time is the distribution of the leaflets. It is here that we would like to ask the help of the Boy Scouts of America, who might, among their many other worthy causes, undertake the responsibility of passing out these leaflets on a door-to-door basis. Perhaps this assignment would assist them in earning their merit badges. For our part, I can assure you that the Scouts would be performing an important service for the community and the State of California."

Scouts Cooperote

The Boy Scouts of America lost no time in endorsing the idea as a good-turn activity in the public interest, and Deputy Regional Scout Executive Jay W. Clements set the organizational wheels in motion with the staffs of the various councils. On July 13 Scout Troops 81 and 82 of the Long Beach Area Council handed out some 2,000 leaflets on a San Gabriel River Freeway job, and on July 18 Scouts from the Orange Empire Area Council, Troops 70 and 78, distributed 2,500 leaflets on a section of the Garden Grove Freeway. Cooperating with the Scouts were the contracting firms of Kasler Constructors & Gordon H. Ball Enterprises and the Guy F. Atkinson Company, who made a donation to the Scout Fund.

Meanwhile, other leaflets are being readied on future freeway construction projects and in most instances will be delivered to residents soon after work starts—courtesy of the freeway builders and the Boy Scouts of America.

Scouts assemble to receive leaflets and instructions prior to making distribution to residents in the area.

Boy Scout headquarters handled all distribution details. William Hayes (white shirt and sunglasses), district executive of the Long Beach Council, was in charge of the activity in Dairy Valley.

Route 36 Relocation

By O. B. HANSON, Resident Engineer

On July 13, 1964, a new link was added to the chain of California freeways and expressways with the opening of a completed 4.75-mile section on Routes 36 and 395 in Lassen County. This section of highway begins in Susanville, 0.3 mile from the east city limits, and terminates one mile east of Johnstonville. The completion of this project marks a total of 21.3 miles of restricted-access highway which has been constructed within the past four years between Susanville and two miles north of Milford.

The new highway replaces a winding, narrow section which was constructed in 1931. The old highway had 13 curves and a minimum radius of 500 feet. Two of the curves are signed for 35 m.p.h. due to the short radius and inadequate superelevation. As this was a two-lane conventional highway traveling through the Honey Lake Valley, there were many business places fronting on the old road plus numerous driveways and road connections. The Route 395 portion of the old highway passed through the center of the village of Johnstonville.

Existing Highway

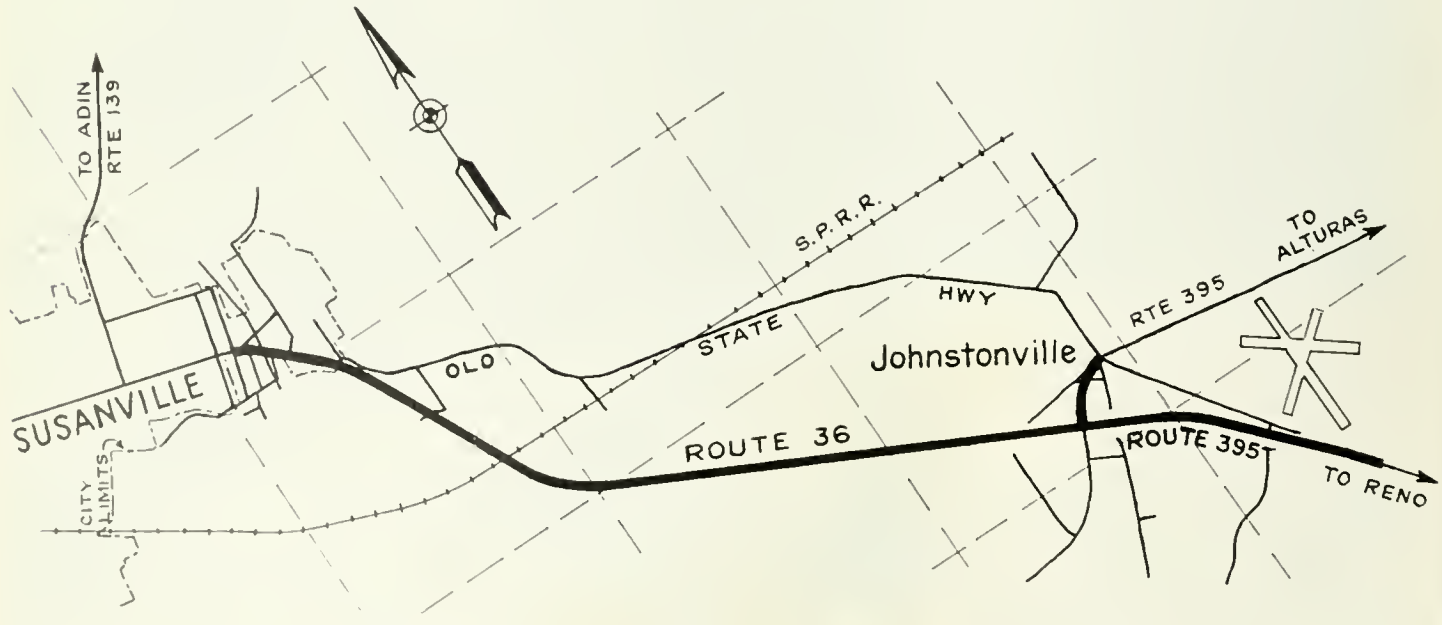
The existing two-lane highway within the city limits of Susanville was converted to a 64-foot all-paved section with asphalt concrete dikes. At the city limits it changes to a 40-foot all-paved section and leaves the existing alignment, proceeding southeast through the Honey Lake Valley. The new alignment conforms to a recently completed project 1.0 mile east of Johnstonville. The realigned portion of Route 395 passes approximately one-quarter mile to the south of the business district of Johnstonville.

The portion of highway constructed on this contract will be the westbound lanes of an ultimate four-lane freeway. Right-of-way has been purchased and fenced for ultimate interchanges at the east city limits of Susanville and at the junction of Routes 36 and 395.

Approximately three miles of the highway was constructed across irrigated meadow with the profile grade held about five feet above the original ground. The bulk of the material used in construction of this embankment came from the interchange area at Johnstonville and from widened cut sections beyond Johnstonville. The cut section at the future interchange area was about 4 feet in depth and varied from 170 to 850 feet in width.

Embankment Section

Construction of the embankment section through the meadow area deviated from normal construction practices in that ditches were excavated the full length of the embankment



This map shows the location of the new highway in relation to the old route.

BEFORE. One of the more hazardous curves on the old highway route near Susanville.

AFTER. A portion of the new Route 36 relocation near Susanville.

BEFORE. The old intersection of Routes 36 and 395 prior to relocation.

AFTER. The completed expressway at the new junction of Routes 36 and 395.

section on each side of the roadway prism to carry off irrigation water, and the sod was left intact as much as was possible. Select material was dozed through the meadow until the spongy material was displaced by the sandy select material. As soon as a stable pad was constructed, normal embankment construction procedures were followed.

Extensive irrigation ditches and pipes were required to maintain flow in the established irrigation areas. Five major structures were installed on this project. Two of these will serve a dual purpose. A double 12-foot by 8-foot reinforced concrete box constructed at Gold Run Creek and a 120-inch field-assembled structural plate pipe installed at Sand Slough will also be utilized as cattle passes during the dry season. A 137-foot-long reinforced concrete bridge was constructed across the Susan River. Prior to the construction of the bridge, the contractor installed an 84-inch-diameter culvert in the river bed and constructed dams at each end of the pipe. This provided a relatively water-free area in which to drive pilings and pour the bridge footings. The contractor utilized the upstream dam as a haul road which enabled him to carry on a continuous grading operation during all phases of bridge construction.

Channelized Intersection

At the junction of Routes 36 and 395, a channelized intersection was constructed as the initial development.

A public stock trail, located within the right-of-way, was constructed from just east of the junction of Routes 36 and 395 to the end of the project. Metal cattle guards were also installed at all road connections in the vicinity of the stock trail to further protect the motorist from stray cattle. This type of facility is a customary provision in this part of the State where livestock raising is an important part of the local economy.

This project was constructed by the L. B. Wells Construction Company of Visalia. John W. Hufford was the Bridge Department representative, and the writer was the resident engineer.

Harbor Boulevard

Accident Survey Shows 54% Drop Since Reconstruction

By CHARLES R. HANDY, Director of Public Works, City of Garden Grove

On October 26, 1962, Mrs. Katherine Barr, Vice Mayor of the City of Garden Grove, cut the traditional ribbon opening Harbor Boulevard to public use. This ceremony signified the completion of a $746,000 street improvement project that had created much controversy between the local businessmen and the city over the design which incorporated raised dividers in an urban commercial area.

Harbor Boulevard reconstruction looking southwest. Garden Grove Boulevard crosses Harbor Boulevard at an angle in the middleground. The shopping center in the foreground is served by a frontage road. Access is provided by a signalized intersection with a public street (foreground).

History

Harbor Boulevard was constructed as a three-lane county highway in 1947 by the Orange County Road Department and was included in the federal aid secondary system prior to the incorporation of the City of Garden Grove in 1956.

Soon after the City of Garden Grove incorporated it became apparent that Harbor Boulevard was outstanding in its need for a major improvement to increase capacity and safety. As a result of an ADT of 25,000 on a three-lane facility, the accident rate was extremely high with corresponding enforcement problems.

In 1958 the improvement of Harbor Boulevard was initiated after its being selected as the most deficient street in the city street system.

Financing

The tentative cost of widening the project to four lanes was estimated to be approximately $500,000. It was apparent that the city could not finance a project of this magnitude; fortunately, two events occurred that enabled the project to be built as a four-lane divided highway.

In 1958 the cities of Orange County and the County of Orange reached an agreement concerning the combined use of the highway users gas tax funds for the improvement of qualified arterial highways throughout the county. This program is known as the arterial highway finance program (AHFP).

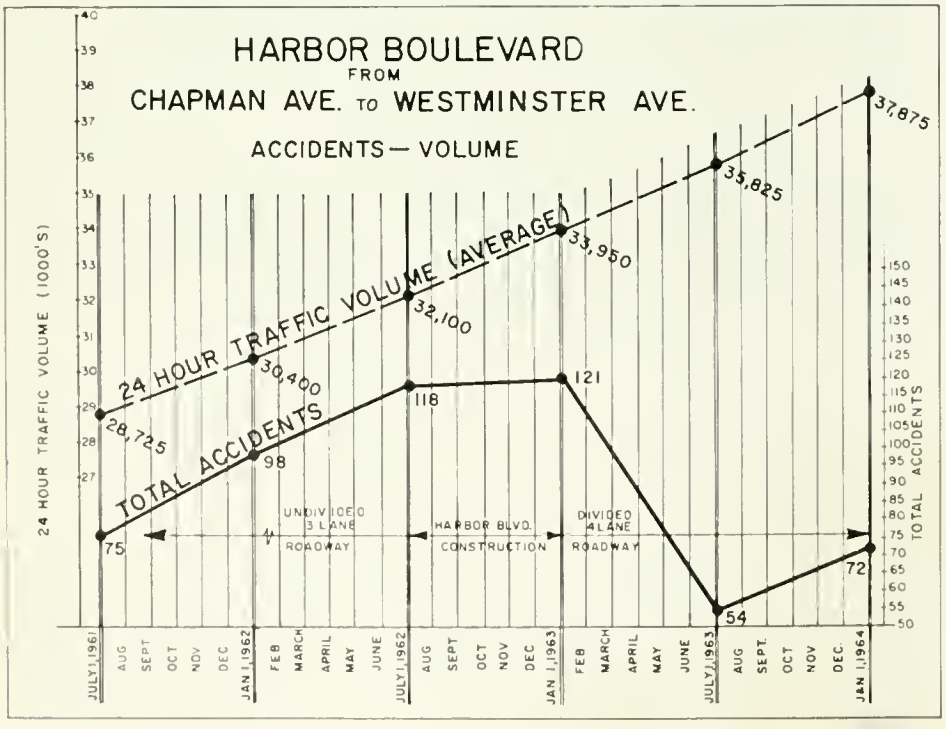
In 1959 the State Legislature created the Federal Aid Secondary Urban Extension Law, which made it possible for cities to obtain financing for urban extensions of FAS routes.

Thus, it was fortunate that the two supplemental sources of financing were available to the City of Garden Grove at the time the Harbor Boulevard project was being planned. These funds assured the completion of the project.

Design

One of the qualifications for receiving funds under the FASUE program was that the project be designed using appropriate standards. The established standards for urban exten-

The southern end of the Harbor Boulevard reconstruction looking north. The future Garden Grove Freeway will cross near the upper part of the photo. The openings and left turn pockets in the center strip were provided for present and future improvements (shopping centers and streets).



sions of federal aid secondary routes called for raised dividers under the conditions that existed on Harbor Boulevard.

In utilizing raised dividers in an urban commercial area, the city engineering staff was apprehensive concerning possible protests from citizens groups during the contract stage of the project, unless a thorough public educational program was initiated during the design stage.

With the concurrence of the city council, staff officials developed a series of public meetings that were designed to enable affected property owners to meet with the staff and be briefed on the design of the project. As the project was approximately two miles in length, four meetings were scheduled, one for each one-half mile section of the project. The property owners and businessmen within these sections were shown slides, maps, and accident histories of Harbor Boulevard and were invited to offer their suggestions and comments. Needless to say, some of the suggestions were not practical, although it was possible to modify the design in some instances to overcome the most serious objections.

After the four meetings were completed, the staff reported to the city council their findings as a result of the hearings together with staff recommendations. From this time on a very complicated series of events, involving the local chamber of commerce, city council, city engineering staff, state highway officials, State Highway Commission, Bureau of Public Roads, State Assemblymen and Senators, took place regarding the necessity for utilizing raised dividers on the Harbor Boulevard project. The final decision to proceed with the construction of Harbor Boulevard, utilizing raised dividers, was made by the Garden Grove City Council and the design of the project proceeded.

Construction

Bids for the project were opened June 7, 1962, and the contract was awarded to the R. J. Noble Company of Orange. Construction started July 9, 1962, and was completed on October 26, 1962, at a total cost of $474,523. Right-of-way costs were

BEFORE—A section of the old three-lane Harbor Boulevard prior to improvement.

AFTER—Harbor Boulevard following improvement with divided roadways and left turn lanes. Accidents have been reduced by more than 50 percent.

$271,449, adding to a project cost of approximately $746,000.

An interesting technique was utilized during the construction stage wherein the City of Garden Grove administered the contract with the County of Orange supplying the resident engineer, inspection, and construction engineering. This is a fine example of the intergovernmental cooperation enjoyed in Orange County which has had very satisfactory results.

Postconstruction Period

During the preliminary design stages and during the public hearings the engineering staff stressed the increased safety and efficiency of raised divider design over a five-lane undivided design. Accident records and traffic counts were maintained before, during, and after the construction period to develop accurate traffic data.

It will be noted from the graph that the accidents remain nearly constant through the construction period; however, after the highway was completed, the total accidents decreased by 54 percent. After a year of operation, this section of Harbor Boulevard has developed an extremely low accident rate calculated to be 4.1 accidents per million vehicle miles with an ADT of approximately 38,000. The need for police enforcement has been cut in half as a result of the increased safety features of the design.

Recently, the city landscaped the divider and painted the asphalt an attractive grass green which has received many favorable comments from citizens in the area.

IN MEMORIAM

District I

Violet E. Randle, secretary I.

George W. Stanig, highway maintenance man II.

District II

Raphael A. Kreizenbeck, highway maintenance man II.

District VII

William E. Melcher, associate highway engineer.

Headquarters Office

Joshua L. Baker, janitor.

Joseph A. Caffrey, supervising right-of-way agent.

Harry E. Kolkebacker, highway engineering technician I.

Materials and Research

Donald R. Whetsel, highway engineering technician I.

ROUTE 58 FREEWAY

The State Department of Public Works has awarded a $1,451,000 contract for constructing eight miles of four-lane freeway on State Sign Route 58 between one-fifth mile east of Keene and four-fifths mile west of Tehachapi Overhead, about two miles west of Tehachapi.

Highway Districts Lose Roman Numerals

Since nobody-can-remember-when, Division of Highways' districts have been officially designated by roman numerals. But effective August 6, this ancient custom (pre-1912) was felled by the ax of progress. The credit goes to the popular changemaker: the electronic computer.

District X is now District 10, and likewise for each of the others. Districts 1 though 9 have a further distinction—a zero before their numbers, just to keep the computer straight in its own mind's eye.

While the zero is necessary for accounting by computer, it won't be used, of course, on maps, letterheads, signs, or other material where it would have little worth. On internal correspondence and other documents, however, the zero will be used to agree with fiscal numerology (see Circular Letter No. 64–235).

Fortunately for all oldtimers who may need a moment to revise their former practices, the change in this numbering system is gradual and simple when compared with the recent major revisions of route numbers. Prior records, signs, installations, plans, files, and so on will not be changed to agree with the new system. And so both numbers—friendly or not—will exist, side by side, in the records until the roman numeral system is ultimately completely outdated.

(*Editor's Note:* The little maps which identify the location of districts at the start of some articles in *California Highways and Public Works* will be "deromanized" in the near future.)

Headquarters Office is affected by the change too, inasmuch as there is a number now for everything. "Sacramento" is, in fiscal essence, District 13, and the Bridge Department is District 14.

This leaves the number 12 unaccounted for, but don't think that the computer has become sophisticated to the point where it has the same aversion to 12 that some people have to 13. Leaving a few gaps here and there is simply the computer's way of coping with future unknowns.

The gradual change in numbering will make the transition less costly and confusing. Present stocks of supplies which bear the roman numerals will be used up before new materials are ordered.

The new arabic numbering ties in with other changes in the accounting procedures which were made at the beginning of the present fiscal year.

Incidentally, there is no Anti-District Dialing League.

Tempus Fugit Column

September 1939—Presidio Tunnel

The Presidio tunnel approach to the Golden Gate Bridge features one of the many unusual types of construction (open cut and backfill) used by highway engineers in these modern days.

The tunnel portion carries the roadway beneath a section of the Presidio used as a parade ground for military maneuvers and a golf course, for which reason an open cut highway was not possible. Due to the sand formation and the small amount of material over the top of the tunnel, it was found more economical and practicable to use the so-called open cut and backfill method.

The tunnel is 1,300 feet long and will accommodate a four-lane highway.

September 1939—87 Coast Bridges Replaced

An article by E. L. Walsh, Associate Bridge Engineer, states that a heavy burden of maintenance and reconstruction was placed on the Division of Highways when in August 1933 an additional 6,780 miles of road were added to the state highway system.

One section of highway presenting a difficult problem is (old) State Highway 56 from Jenner to Westport along the northern Mendocino County coast.

A thorough engineering investigation of each of the bridges revealed that the majority of them were not safe for legal loads. In the section from the south Mendocino County line at the Gualala River to Westport, a distance of 81 miles, there were 84 timber bridges with a combined length of 16,812 lineal feet. Only five of them were capable of supporting legal loads.

A large percentage of these bridges were constructed previous to 1910; at least ten were constructed before 1900, and one, Dark Gulch Bridge, was built in 1874. These bridges were designed to support a six-horse team with a loaded wagon, a load far below the required capacity of modern traffic.

October 1939—$500,000 Storm Damage

Riverside and Imperial Counties, normally desert country, experienced torrential rains last month which washed out 35 miles of highway, approaches to six bridges, and a number of protective dikes between Indio and Blythe on US 60 and 70. Extensive damage was also done on US 95 and 99 and (old) State Highway Routes 111 and 195.

Heavy and steady rainfall on September 4 and 5 was climaxed by rains of record intensity on the 6th. The heaviest fall reported was in Brawley—6.43 inches in approximately 24 hours, or three times the average *annual* rainfall for that vicinity.

September 1939—Pacheco Pass Realignment

The 2.2-mile realigned section of State Highway Route 152 traversing the historic Pacheco Pass in Santa Clara County opened to traffic August 12 represents elimination of 31 curves on the old road.

The principal item of the contract involved moving approximately 600,000 cubic yards of excavation. During the period when the dirt was really flying, there were 12 carryalls in operation and 6 bulldozers. Distance of the new highway, 2.63 miles, is eight-tenths mile shorter than the old, and the grade has been reduced to 6½ percent, versus 7 percent for the old.

* * *

"Highway to the Stars" recently constructed up the south slope of Mt. Palomar in San Diego County, leads to the observatory housing the largest telescope in the world. Beginning about five miles east of Rincon on Secondary State Highway 195, it rises from an elevation of 2,670 feet to 5,568 feet in 12 miles, via grades not exceeding 8 percent and curves not sharper than 100-foot radius.

The Freeway Law

Statute's History Retold on Its 25th Anniversary

By FRANK B. DURKEE

The California freeway legislation of 25 years ago evolved from the realization by attorneys and engineers of the State Department of Public Works that the requirements of modern highway transportation could no longer be met by continuing construction of highways that conformed to legal concepts of the rights of abutters which long antedated the day of the motor vehicle. It was an attempt to modernize the highway law; to eliminate hazards and promote safety; and, particularly, to protect and insure the tremendous investment California was making in its highway system.

The thinking that led to what has sometimes been described as a "revolutionary" proposal came out of the hectic years of the 1930s. When the writer looks back at the nearly 18 years he spent in the legal division, this period stands out in many ways as the most exciting. It was a time of change, of new problems to be faced, and development of new ideas for their solution.

7,000 Miles Added

Despite the depression, California had available funds for the prompt matching of the millions of dollars of federal aid which became available during those years. The Legislature, in an effort to aid the counties, by a single action in 1933, added 7,000 miles to the state highway system, doubling the mileage. In 1935, it added Section 111 to the Streets and Highways Code making it clear that, henceforth, the State was to assume responsibility for the construction and maintenance of state highways within cities, a reversal of a commission policy first adopted in 1912.

Four-wheel brakes and increased horsepower were contributing to increased speed of motor vehicles. Use of the highways by commercial vehicles was increasing at a rapid rate. The new three-axle trucks, truck-trailer, and other combinations were demanding of the Legislature the privilege of carrying increasingly wider and heavier loads which the engineers feared existing pavements could not carry and for which existing traffic lanes were too narrow.

To meet these needs, engineers were adopting thicker pavements, wider traffic lanes, improved shoulders, physically divided highways, outer service roads, and from efforts to build these new highways there arose an ever increasing number of legal problems.

Editor's Note:

Frank B. Durkee, who prepared this article at request of the editor, began his career in state service on November 1, 1923, as editor of *California Highways*, the first issue of which appeared in January 1924. Following his admission to the California bar, he was delegated the task, in 1927, of preparing a plan for the organization of a Right of Way Department by State Highway Engineer R. M. Morton. He resigned in February 1928, but returned to state service as a member of the staff of the Division of Contracts and Rights of Way in February 1931. He held the position of principal attorney when he was appointed Deputy Director of Public Works by the late C. H. Purcell in May 1948.

When Mr. Purcell retired in 1951, Mr. Durkee was appointed on August 3, 1951, to succeed him as Director of Public Works by Governor Earl Warren. He continued in this position until his retirement on January 1, 1958.

Since January 22, 1958, Mr. Durkee has been a member of the Redevelopment Agency of the City of Sacramento under appointment by the city council, and has also engaged in legal and consulting work.

It was also the time of the building of the San Francisco-Oakland Bay Bridge, with the consequent disruption of street patterns at the approaches in San Francisco which gave rise to questions never before settled by the courts of this state.[1]

Arroyo Seco Parking

In Los Angeles County the late Spencer Cortelyou, District Engineer in District VII, was wrestling with problems of the Arroyo Seco Parkway, eventually to become "the first freeway in the West," and looking forward with great pride to the completion of a new "superhighway" largely on new alignment between Los Angeles and Pomona, old Route 26. For the most part it had been built through open country on new right-of-way donated by owners of the abutting land. It was completed in 1937 as a four-lane highway with only two traffic signals and two boulevard stop signs in 27 miles.[2] Immediately it attracted a large volume of traffic of all kinds, including commercial trucks hauling produce from the Imperial Valley to Los Angeles markets. And what happened?

This volume of traffic at once began to attract a low-grade, heterogeneous ribbon development extending for miles. This in turn brought about more stopping, parking and conflicting movement until Mr. Cortelyou's great achievement had become a congested and hazardous highway, "functionally obsolescent," with a legal speed limit in many sections of 25 miles per hour. The motorist who had helped pay for the badly needed improvement under California's pay-as-you-go plan was taking a tremendous loss on his investment. On the other hand, the property owner, either directly or through his tenants, was asserting his right, as an abutter, to

[1] See *Bacich* v. *Board of Control*, 23 C. 2nd 343 144 Pac. 2nd 818.

[2] *California Highways*, April 1937, page 4.

direct access to the highway for what he considered legitimate personal gain. From the standpoint of those interested in adequate highways to serve the fast-growing State, proprietors of these roadside businesses were simply exploiting the traffic generated by the public improvement.

All this made Garvey Avenue exhibit A in California of what had to be overcome if our modern highways were to perform the functions for which they were intended. There were, of course, other similar situations in California, but the new District VII improvement seemed to be the most striking example of what was happening on many routes throughout the State.

Origin of Abutters' Rights

While the precise origin of the right of access from abutting property to a public street or highway is said to be somewhat obscure, it is generally agreed that it was created by judicial decision and that its concept had its roots in the common law of England. In the United States, certainly, it has been supported by a long line of cases going back many years. This long-established right of an abutter to access to the highway in front of his property was not a matter of great consequence in the days of the horse and buggy. But in the era of modern, high-speed automotive traffic, as the Garvey Avenue Development so clearly demonstrated, it had become utterly inconsistent with the rights and protection the highway user demanded and was entitled to on a through highway of this character. There was also the very important question of the preservation of the public's investment in its new highways.

Work nears completion in early 1937 on the new Garvey Avenue "superhighway" in Los Angeles County, a four-lane roadway with only two traffic signals and two boulevard stops in its entire 27 miles. In a few years it had become lined on both sides with small stores and stalls of all kinds bringing with them traffic congestion and the need for innumerable 25-mile-per-hour zones.

Attorneys in the Department of of Public Works, including our trial attorneys in the San Francisco office, were greatly concerned about this problem and it was the subject of continual discussion. We were pretty well agreed that there was grave doubt that the existing statutory authority to acquire rights-of-way would include acquisition or abatement of "abutters' rights."

Engineers were becoming aware that the building of divided highways, and other improvements that were being attempted was not enough. In *American Highways* for July 1937, the late Fred J. Grumm, Engineer of Surveys and Plans for the California Division of Highways, had written:

> ". . . Accident analysis . . . shows that dividing roadways can only minimize a relatively small percentage of accidents prevalent on four-lane roads unless the improvement includes other features, such as . . . embodiment of the *freeway* principle. . . ."

In Los Angeles, a committee set up by the Automobile Club of Southern California had said in a report, dated December 16, 1937:

> "It is . . . apparent that this growing congestion and accident toll (on the streets and highways of the Los Angeles area) is the direct result of an attempt to serve both *abutting property* and through traffic upon the same street or highway . . . the only permanent solution is to provide facilities for the exclusive use of motor vehicles."

Mr. Carleton's "Boys"

For most of the time during the '30s the Central Office legal staff for highways consisted of the late C. C. Carleton, as Chief Counsel and Chief of the Division of Contracts and Rights of Way, who recently passed away at the age of 85, the late C. R. Montgomery, the late Robert E. Reed, and the writer. Mr. Carleton called the three of us "his boys." We had the highest regard for one another and for our chief. Both Mr. Montgomery and Mr. Reed later succeeded to the position of chief counsel.

Typical of modern, full freeway development is the San Bernardino Freeway which now carries heavy traffic through the same areas as those originally intended to be served by the old Garvey Avenue "superhighway." (See photo previous page.)

It was our custom between sessions of the Legislature to maintain a file, sometimes referred to as our "idea" file, in which we placed memoranda relative to problems concerning which legislation appeared to be needed. Any of us who encountered such a problem would prepare a brief memorandum of the facts together with our suggestions for this file. Prior to a general session of the Legislature, these suggestions would be reviewed, generally with a representative of the State Highway Engineer sitting in, and out of such conferences would come the legislative program of the department for the ensuing session. When the proposed program had been approved to the extent the director might require, drafts of bills would be prepared and offered to legislators for introduction.

The 1939 freeway bill was developed in this manner. It is the writer's recollection that it was drafted and handled before the legislative committees largely by Mr. Montgomery. Working with him was Mr. Grumm, Engineer of Surveys and Plans, as representative of the late C. H. Purcell, then State Highway Engineer, and later to be Director of Public Works. Frank W. Clark was Director of Public Works, and his special representative in legislative matters was Harold P. Norton.

Legislative Progress

The freeway legislation of 1939 was introduced in the Senate by Senator

Arthur H. Breed, Jr., of Oakland. He was introducing it for the Department of Public Works and the bill was in fact what is now designated as a "departmental bill."

Senator Breed had followed his illustrious father as representative of Alameda County in the upper house. The elder Breed, among other distinctions, in his time, had served as President pro Tempore of the Senate and as Chairman of the Highway Advisory Committee of 1923, popularly known as the "Committee of Nine." It was this committee that recommended to the 1925 Legislature that "financing of state highway construction be changed . . . to the 'pay-as-you-go' method" and that "the revenue for this construction program be derived from increased taxes upon the users of motor vehicles . . . ."[3]

The elder Breed was also the author of the subsequent "Breed formula" for the allocation of state highway funds to county groups, north and south, the subject of much controversy in connection with the expenditure of the original bond funds.[4]

As editor of *California Highways*, the writer traveled to all parts of California with the "Committee of Nine." Senator Breed frequently brought along his young son, Arthur, Jr., who celebrated his 21st birthday on one of these trips. It was with this background that he came to the Senate and it was only natural that he would be interested in highways.

Bill Is Introduced

The freeway bill was introduced on January 25th. As Senate Bill 848, it was referred to the then Committee on Roads and Highways, of which Senator Thomas McCormack, of Rio Vista, was the chairman. Senator McCormack had served as a member of the Board of Supervisors of Solano County prior to his election to the Senate, and was well aware of the problems, financial and otherwise, faced by the California Highway Commission and the Division of Highways. Upon his death in 1949, the commission adopted a resolution expressing its sorrow at his passing and its deep appreciation for his many years of interest and support.

The bill, as introduced by Senator Breed and favorably reported on by Senator McCormack's committee was a simple one, consisting of but four sections, the first of which added Section 23.5 to the Streets and Highways Code to define "freeway" as:

> "A highway in respect to which the owners of abutting lands have no right or easement of access to or from their abutting lands or in respect to which such owners have only limited or restricted right or easement of access."

This definition has never been amended.

Section 2 added Section 100.1 to the code and it likewise has not been amended. This section is the heart of the law. It reads:

> "The Department [of Public Works] is authorized to do any and all things necessary to lay out, acquire and construct any section or portion of a State highway as a freeway or to make any existing State highway a freeway."

Sections Are Added

Sections 2 and 3 of the bill added Sections 100.2 and 100.3, respectively, to the code. It was these last two sections that caused controversy as the measure progressed through the Legislature. By referring to the statute as it now reads, the effect of the wording of the adopted amendments may be understood.[5]

The committee had recommended but a single amendment, which was adopted by the Senate on March 24. It consisted of the addition of the following language to Section 100.3 as it was originally written:

> "Such declaration [of the California Highway Commission] shall not affect private property rights of access, and any such rights taken or damaged within the meaning of Article 1, Section 14, of the State Constitution for such freeway shall be acquired in a manner provided by law."

The adoption of a resolution by the commission could not, of course, have the effect of taking or damaging private property rights. But the additional language of the committee amendment made the legislative intent clear that abutters' rights of access were to be acquired or extinguished only by some lawful means, i.e., donation, purchase, or condemnation.

The bill in this form came to a vote before the Senate on March 27, and, to the consternation of the departmental representatives and its supporters, received only 15 affirmative votes to 20 opposed. Senator Breed immediately gave notice of reconsideration, which was continued from day to day until March 31, when reconsideration was granted. On this date, a further amendment offered by Senator Breed, this time to add additional langauge to Section 100.2, was adopted.

Agreements With Local Bodies

As originally introduced, Section 100.2 simply authorized the Department of Public Works, when required by freeway construction, to close city streets or county highways at their points of interception with freeways or to make provision for connections to or separations of the grades of such streets or roads and the freeway. The additional language providing for agreements with local governing bodies has become a most important part of the whole freeway procedure. Instead of empowering the department to act on its own volition, it was, by the amendment, authorized

> "to enter into an agreement with the city council or Board of Supervisors having jurisdiction over the street or highway and, as may be provided in such agreement"

to close streets or highways, or to take the other actions indicated.

Senator Breed recalls that this amendment was one of the two most important questions raised during consideration of the bill. As amended, it came up for vote during a call of the Senate on April 3 and was adopted, with 33 affirmative votes and none in opposition. Of those present and voting for the freeway legislation that day, only Randolph Collier, of Yreka,

Report, page 68.
[4] Streets and Highways Code, Sections 187, 188.

See *Senate Journal*, 1939 session, for amendments and roll calls on the several amendments and on final passage of Senate Bill 848.

is still a Member of the Senate. In the 25 years since then, he has come to be recognized as a forceful exponent of the freeway idea.

Bill Reaches Assembly

The bill reached the Assembly on April 4 and was referred to its then Committee on Roads and Highways, of which Assemblyman Albert W. Robertson, of Santa Barbara, was the chairman. On April 19, this committee reported the bill to the Assembly "do pass," and a month later, on May 18, it was adopted with 47 affirmative votes.[6]

Among those present and voting for the measure on that day was a young Assemblyman from Anaheim by the name of Thomas Kuchel, now the senior U.S. Senator from California. Others were Assemblymen Augustus Hawkins and Cecil R. King, now Members of the House of Representatives; George P. Miller, now State Senator Miller; and the late Michael J. Burns, then Assemblyman from Humboldt County, whose name will ever be connected with that most important piece of highway legislation, the Collier-Burns Act of 1947." Paul Peek, now Associate Justice of the State Supreme Court, was the Speaker.

Following Assembly action on May 18, Assemblyman Earl D. Desmond, of Sacramento, gave notice that on the next legislative day he would give notice to reconsider. The record shows, however, that on June 5 reconsideration was granted upon motion of Assemblyman Charles W. Lyon, of Los Angeles, who offered a still further amendment to Section 100.3, reading as follows:

> "No State highway shall be converted into a freeway except with the consent of the owners of abutting lands or the purchase or condemnation of their right of access thereto."[7]

It would seem that this would have been the legal effect of the section in any event. The added language, however, was a further expression of the intent of the Legislature that private property rights of access were to be fully protected and indicated the caution with which the Legislature gave its authorization for the building of this new kind of highway in California.

The bill with the additional amendment, which had been adopted, was finally passed by the Assembly on June 19, with 49 affirmative votes and none in opposition.[8] The Senate concurred and sent the bill to Governor Culbert L. Olson who signed it on July 1. It became effective September 19, 1939, Chapter 687 of the Statutes of 1939.

[6] *Assembly Journal*, 1939 session, page 2196.
[7] *Assembly Journal*, pages 2754, 2755.
[8] *Assembly Journal*, 1939 session, page 3221.

Mr. Corleton's 1939 Report

Reporting on legislation affecting highways adopted by the Legislature at its 1939 session, Mr. Carleton, in the October 1939 issue of *California Highways* said:

> ". . . Three laws enacted . . . should prove of inestimable value in carrying on California's program of developing high-type highways adequate to care for the ever increasing volume of traffic, particularly on the main line routes and in and around the metropolitan centers . . ."

The first listed was Chapter 687, authorizing establishment of freeways

The first freeway to be constructed in California was the Arroyo Seco Parkway (now the Pasadena Freeway). It was opened to traffic in 1940.

on the state highway system. This statute, he said, places "this State among the highway leaders . . . in the nation . . ."

The other two were Chapters 359, authorizing cities and counties to establish and construct freeways, and Chapter 268, specifically authorizing the Department of Public Works to construct divided highways and highways with paralleling service roads and other safety features on the state highway system.

The act authorizing cities and counties to construct freeways, appears to have received legislative approval with little or no opposition or controversy. It was through the Legislature and was signed by the Governor on June 2, 1939, approximately a month before similar legislation respecting state highways was ready for his approval.

Amendments of 1953, 1957

Since its enactment in 1939, two important amendments to the original law authorizing establishment of freeways on the state highway system have been adopted. Both were enacted during the writer's period of service as Director of Public Works.

The first was an amendment to Streets and Highways Code Section 100.2 to clarify the language authorizing agreements between the department and cities and counties and was worked out by the late Robert E. Reed and representatives of the League of California Cities. It was agreed to by the department. Chapter 1200 of the Statutes of 1953 inserted, in Section 100.2, this language:

> "No city street or county highway shall be closed, either directly or indirectly, by the construction of a freeway except pursuant to such an agreement or while temporarily necessary during construction operations."

Chapter 1217 of the Statutes of 1957 added a new Section 100.25 to the code, as follows:

> "In addition to the other matters that may be covered by the agreements authorized under Section 100.2, provisions for improvements, revisions or extensions of city streets or county highways leading to or from a freeway, deemed by the department to be necessary in accommodating the freeway traffic in making proper connections between the existing system of city streets or county roads and the freeway, may be included in such agreements and the department may perform such work as a part of the freeway construction."

Interstate 80 (old US 40-99) north of Sacramento was the center of a case in 1949 in which the constitutionality of the freeway statute was affirmed by the State Supreme Court.

This addition was desired by the Department of Public Works to clarify and to some extent extend its authority for the expenditure of state highway funds "for making proper connections between the existing system of city streets or county roads and the freeway." It was also the result of the work of Mr. Reed. It provided statutory authority for spelling out in greater detail the work to be done in connection with interchanges, on and off ramps, and other changes that affected local streets and highways, and no doubt, has aided in bringing about a better solution of these problems as well as more harmonious relations between the department and local governing bodies.

Legislation in Other States

Until the writer undertook the preparation of this article, it had been his thinking that the California act was the first freeway law to be enacted by any state. However, the fact is that in 1937 the Legislature of Rhode Island adopted an act relative to "the construction, maintenance and improvement of freeways" (Chapter 2537, Public Laws of 1937), and that a somewhat limited freeway law was also adopted about the same time by the State of New York.[9] Special statutes providing for parkways and toll roads, to which the concept of abutters' rights apparently did not apply, had been adopted in a number of eastern states, but they were not of general application. Inasmuch as the Rhode Island statute is somewhat similar to the California law, as originally proposed, it may be that Mr. Montgomery had available to him a copy of this act. To the best of the writer's recollection, however, there was no discussion in our office at the time of any such law.

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[9] Cahill's Consolidated Laws of New York, 1937 Supplement, Chapter 27.

In any event, the action of the California Legislature and what was being done here by the Division of Highways, attracted widespread attention throughout the country and within a short period similar freeway statutes had been adopted in a number of states. All the states are now understood to have this power, either by statute or decisions of courts. The 1956 federal aid legislation, strongly supported by California, provided for access control on the new "national system of interstate and defense highways." This was the first such action by the federal government.[10]

Constitutionality

Construction of the new restricted-access type of state highway provided for by the 1939 legislation provoked numerous legal problems, but it was 10 years before the question of the constitutionality of the statute was squarely presented to and decisively disposed of, in the affirmative, by the State Supreme Court in the case of *Holloway* v. *Purcell*, 35 Cal. 2d 220. In this action the petitioners had sought to enjoin building of the Sacramento-Roseville Freeway in an all-out legal attack on the State's freeway program. The decision was reviewed at some length by the writer in the July–August 1950 issue of *California Highways*.

Just as he had presented the case for the law before the Legislature, C. R. Montgomery defended it before the courts. The State's brief was largely his work. The writer was with him at the hearing before the Supreme Court, and his ability to present a clear, incisive and powerful legal argument was never better demonstrated than on that occasion. The decision of the court was handed down on April 25, 1950, only a few days after Mr. Montgomery's untimely death.

Supreme Court Opinion

The thinking of the court is well expressed by two phrases from the opinion of Mr. Justice Traynor, now the Chief Justice, which bear repeating. One of the arguments put forth to support the claim of invalidity of the freeway act was that Article IV, Section 36, of the State Constitution, adopted by the people in 1902, precluded "construction of any type of highway not in general use in 1902." After pointing out that the type of highway that is adequate to meet highway needs necessarily varies with the character and extent of those needs, Justice Traynor said: "Highways adequate for the horse-and-buggy traffic of 1902 are not adequate for the high-speed traffic of 1950." And at another place in his opinion he said that what the petitioners were really contending for was a "changeless highway in a changing world."

The court unanimously concluded that "construction of freeways and limited access highways is 'necessary or proper to construct and maintain' a modern state highway system." A petition to have the decision reviewed in the United States Supreme Court was denied.

Thus was the right of the department under the freeway statute "to take or damage rights of access," when the owners were compensated therefor, fully upheld.

The California Freeway System

A statewide system of freeways for California by *statute* was envisioned as early as 1945, when legislation having such a purpose was first proposed. The commission and the Division of Highways, however, were already moving ahead with the establishment of such a system, embracing the main trunk highways and major urban routes in the state highway system.

As director, the writer endeavored at every opportunity to point this out in an effort to keep the public fully informed respecting highway developments.

In 1957, the Legislature by Senate Concurrent Resolution 26 requested the Department of Public Works "to undertake a study . . . for an overall statewide plan of freeways and expressways for the State of California . . ." The study was to include highways both on and off the then existing state highway system. This, of course, made it possible to include in the subsequent report all portions of the designated "national system of interstate and defense highways" in the State, as approved by the Bureau of Public Roads, as well as other highways which the department and its consultants and advisory committee deemed logical parts of such a statewide system.

As was pointed out in the department's report of September 1958 to the Joint Legislative Interim Committee on Highway Problems:

> "The establishment . . . of a statewide system of freeways will provide a basis for state, city and county authorities to coordinate all transportation plans, to work out the necessary financial arrangements therefor, and to encourage and promote the development of land use planning."

Such a system was established by the Legislature in 1959.* For the purposes of the new system only, the terms "freeway" and "expressway" were more specifically defined and, wisely, the authority of the department to construct other state highways, not on the system, as freeways was in no way impaired.

First in Nation

As we know, the California freeway system is the first such statewide plan to be authorized in the nation. As now visualized, it totals some 12,250 miles, rural and urban, approximately 11 percent of all public roads in the State. When completed, its planners expect it to accommodate approximately 59 percent of the estimated 1980 statewide travel by motor vehicle.

It was a bold and logical development based on all that had gone before—from the first official recommendation for the establishment of a system of state highways of 4,500 miles, made by the Bureau of Highways in 1896, in the days before the automobile, to the department's Resolution 26 Report of 1958.

Many are entitled to credit for what has been accomplished over the years. But it does not appear beyond the fact to say that in the firm resolve of those who met in conference in the legal office of the Department of Public Works, in the winter of 1938, "to do something about the law of abutters' rights," our great freeway system had its beginning.

[10] Public Law 627—84th Congress, Chapter 462, 2d Session.

* Chapter 1062, Statutes 1959, as amended; Streets and Highways Code, Section 250 et seq.

Roadside Rests

250 Units Will Be Built Within Next Seven Years

Within the next six or seven years California will have some 250 safety roadside rest areas along its state highways, under a program approved by the California Highway Commission. To implement the program will require an annual appropriation of about $800,000.

According to State Highway Engineer J. C. Womack, current status shows 46 rest areas now planned or constructed; 16 of these are in use, and 30 are included in the current state highway budget. Construction will continue on approximately 25 units per year until the system is complete. Where possible, the rest areas will be built concurrently with highway construction. On highways where no improvements are scheduled, the facilities will be constructed under separate contract.

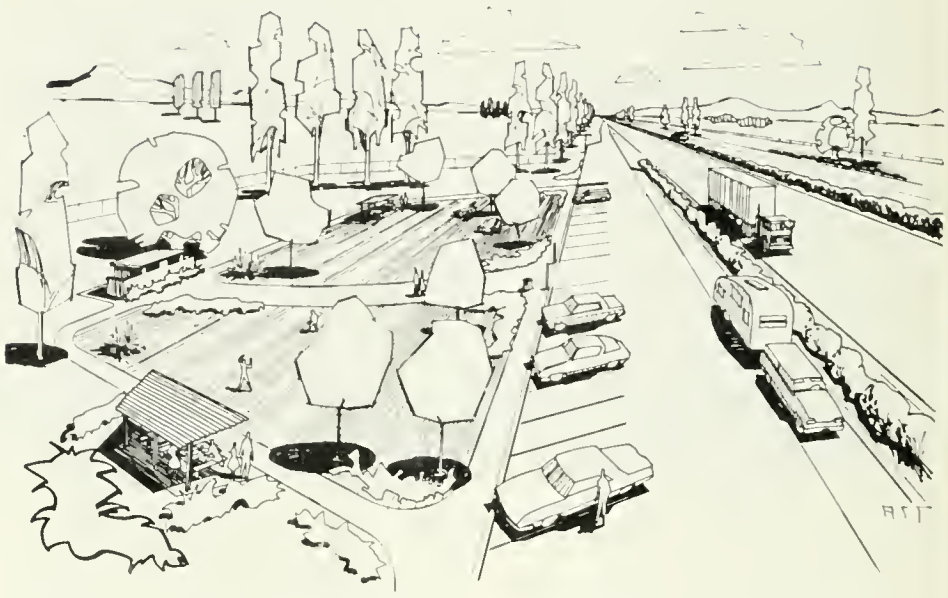
"A great deal of thought and study has preceded the legislation to provide these rest areas," said Womack. "Latest of the investigations and reports was a master plan and cost estimate submitted by the Division of Highways in October 1962 at the request of the Senate Factfinding Committee on Transportation and Public Utilities.

"With the annual 82 billion miles of travel on California highways, these rest areas will not only make travel more pleasant, but can promote safety by preventing driver weariness and thereby reducing accident rates."

Three Sizes

Three general sizes of rest areas are being provided, most incorporating sanitary facilities, water where feasible, and shade trees.

The largest will contain parking space for 20 to 30 cars and 4 to 6 trucks. They will have 6 to 8 picnic tables, and will be situated along interstate routes and other main highways. On highways of four or more lanes, rests are provided in pairs—one for each direction of travel. One such "double" area is presently under construction on Interstate 80 near Donner Summit. The future Westside Freeway (Interstate 5) will feature six pairs of rest areas on its new alignment between Wheelers Ridge in Kern County and the vicinity of Tracy in San Joaquin County.



This artist's sketch shows a typical rest area of the type being constructed along interstate routes. This particular sketch portrays construction now taking place on Interstate 5 at San Luis in Merced County, 10 miles west of Los Banos. As on all major highways, these areas will be constructed in pairs—one to serve each direction of travel.

The medium-size units, to be located along less heavily traveled routes, will have accommodations for 13 to 18 cars, and 1 or 2 trucks. Small units with parking for fewer cars, will be constructed along highways of lighter volume. Picnic tables are optional in medium and small rest areas.

It is planned to space these areas so that in combination with other stopping facilities they will be available at intervals of approximately one-half-hour normal driving time. Scenic attractions and points of historic interest will be considered wherever possible.

Areas Now in Use

Of the areas already in use, five are on the interstate system. They include four between Baker and the Nevada state line on Interstate 15 and one in the vicinity of Midway Wells on Interstate 8 east of El Centro. These are complete only insofar as parking and picnic facilities are concerned. Comfort facilities will be added within this fiscal year.

Thirteen units now under construction are also on the interstate highway system. In addition to those on Interstate 80 near Donner Summit, they are located as follows:

Five are on Interstate 5, with two in the Red Bluff area, two in the Los Banos area, and one near the Los Angeles-Kern county line. Two are on Interstate 15 between Barstow and Baker. Four are on Interstate 10 in Riverside County, two being east of Indio and two between Redlands and Beaumont.

The additional 17 slated for construction in this fiscal year are at

various locations throughout the State. One large unit will be constructed on U.S. 101 at the north end of the Golden Gate Bridge, serving southbound traffic, primarily for map inspection and orientation before entering San Francisco. A footpath underneath the bridge will connect this rest area with the existing vista point on the east side of the road, which is now accessible by auto to northbound traffic only. Another large unit will be located at Batiquitos Lagoon on Interstate 5, 25 miles north of San Diego. Pairs of large units will be in Santa Barbara County near the south portal of Gaviota Tunnel and in Tulare County on U.S. 99 three miles north of Tipton.

Medium-size Areas

Medium-size rest areas will be located in Del Norte County at the south portal of Collier Tunnel; in Humboldt County on U.S. 101 at the Salmon Creek Road interchange near Myers Flat; and a pair of units in Mendocino County on U.S. 101 near Sherwood Road and at Old Irvine Lodge 15 miles north of Willits. Siskiyou County will have a rest area on U.S. 97 at Grass Lake (20 miles north of Weed). Medium-size units will also be constructed on State Route 17 at Saratoga Gap on the Santa Clara-Santa Cruz county line; in Kern County on Route 14, 22 miles north of Mojave; and in Mono County on U.S. 395 near Casa Diablo, 42 miles north of Bishop.

Of the small units slated for current fiscal year construction, one is in Tehama County, on State Route 36 near Mineral, 41 miles east of Red Bluff. One is being considered for Placer County and another for San Luis Obispo County.

Earlier legislation in 1956 had established a limited rest area program to be carried out by the California Division of Beaches and Parks. From the funds allocated, 11 rest areas were established along state highways and 24 within state parks. With the 1963 legislation, the 11 constructed along highways were transferred to the jurisdiction of the Division of Highways, and are included among the 16 now in use.

BRIDGE DEPARTMENT ENGINEER WINS DESIGN AWARD

The Cold Spring Canyon Bridge is located on Route 154 in Santa Barbara County. Its 700-foot span rises 400 feet above the canyon floor.

Marvin A. Shulman, associate bridge engineer with the State Division of Highways, has been announced as a fifth-place winner by the James F. Lincoln Foundation in its national welding design awards for progress in welded steel design.

MARVIN A. SHULMAN

Shulman's award, which also brings him a cash prize of $1,500, was given for his design of the Cold Spring Canyon Bridge on Route 154 in Santa Barbara County (See September-October 1963 issue of the magazine).

Reportedly one of the 10 longest steel arch bridges in the United States, the Cold Spring Canyon Bridge is one of the first major arch units entirely fabricated from arc welded steel. The award cites a 22 percent saving in the $1,900,000 overall price of the 700-foot span through the use of arc-welded steel. Additional advantages cited in the award were decreased design time and increased aesthetic value.

The bridge provides a 28-foot roadway between 3-foot barrier curbs and is 1,218 feet between abutments.

Shulman was cowinner with the Bridge Department's William J. Jurkovich and Douglas M. Fraleigh of a $5,000 second honorable mention award in the steel highway bridge design competition sponsored by the American Bridge Division of U.S. Steel in 1959. (See November–December 1959 issue of the magazine.)

He also won first honorable mention in the American Institute of Steel Construction competition in 1957 for a design of the Trinity River Bridge.

Shulman received his engineering degree from the University of California in 1951 and joined the Division of Highways the same year.

He has served as project engineer in preparation of contract plans for various types of bridge structures.

Landscape Pioneer Dana Bowers Retires

H. Dana Bowers, supervising landscape architect, has retired after 40 years of State service, the last 35 of them with the Division of Highways.

A pioneer in roadside development, Bowers started selecting and developing vista points and fountains along the highways for the State in 1929. He was put in charge of the development of roadsides for the whole state highway system in 1935. Since that time he has supervised the planting of trees, shrubs, flowers and vines along more than 1,000 miles of freeways and expressways.

He recently was recipient of the award of achievement of the Western Chapter of the International Shade Tree Conference at its annual meeting in Seattle. The award is made to a person or firm who has made a significant contribution to promoting and advancing the use of shade trees in the western area. Bowers was honored by a standing ovation when the award was announced.

H. DANA BOWERS

In the presentation of the award, Bowers was cited as one who has "planted more ornamental trees and other plants over a greater area for the enjoyment and safety of more people than any other person in the west during his four decades with the State of California. He has searched for and tried every known plant which might fit somewhere into the varied roadside conditions of his State."

His findings have been used by landscape contractors, government agencies and individuals throughout the United States. Many engineers and students from overseas have come to study his methods and work.

Bowers' work also resulted in new standards for erosion control. He is the author of "Erosion Control on California State Highway," which has become a basic text for the Division of Highways as well as for other agencies and engineers.

A native of Iowa, Bowers came to California in 1903 and attended grade and high school at Gardena and Santa Cruz. He later studied at the University of California at Davis.

He went to work for the State Division of Forestry in 1924 and joined the Division of Highways in 1929.

Bowers is a charter member of the original Western Shade Tree Conference, which he helped organize in 1934.

Bowers and his wife have one son.

Division Wins Safety Council's Award of Merit

J. C. Womack, State Highway Engineer for the Division of Highways, receives the National Safety Council's Award of Merit from James O. Burpo, Sacramento Safety Council President, in ceremonies at a California Highway Commission meeting.

The State Division of Highways has received an award of merit from the National Safety Council.

The award, for "a noteworthy safety performance, 1963" was presented to J. C. Womack, State Highway Engineer, at the start of the two-day monthly meeting of the California Highway Commission on August 31.

In 1963, the State Division of Highways had an accident frequency rate of 9.42 per million work hours, as computed by the American standard method for recording work injuries. The accident frequency rate for California highway personnel for the three years 1960–62 was 12.18, while the national average for all state highway departments was 12.55 for the same period. California, Womack reports, had had an almost continuous reduction in work accidents by people in the highways program since 1952.

James O. Burpo, president of the Sacramento Safety Council, presented the award of the national safety group. In accepting the wall plaque, Womack paid tribute to the more than 17,000 highway employees throughout the State whose achievements in safety and accident prevention made the award possible.

Inspection Training

By LEIGH SPICKELMIRE, Assistant Engineer—Construction and
MORRIS REDSUN, Training Assistant

Where should aggregate samples for control tests be taken? When should pigmented curing compound be applied to concrete? Plastic cracking results from what condition?

The answers to these questions and others are contained in a 12-hour training program, "Inspection Procedures for Portland Cement Concrete Construction," developed and given by the Division of Highways during the last year. The course was taught to 1,280 division engineers.

In 1959 and in 1961, we held training courses covering broad aspects of portland cement concrete paving procedures. In 1963, we needed a course with a different emphasis. New methods and techniques in portland cement concrete construction required a more comprehensive training program, dealing primarily with inspection procedures.

Course Is Developed

The course to meet these needs was developed by Headquarters Construction, with the assistance of the Portland Cement Association and the Division of Highways Training Section. It

Dave Swanson, Bridge Department, uses slides to explain features of the Bidwell Bridge deck finisher to a trainers session for inspection procedures for portland cement concrete construction.

Leigh Spickelmire, Headquarters Construction, holding a test care. The exhibit table contains an Idaho Sand Shaker and aggregate samples used in conducting small group lectures.

Joe Dobrowolski, Portland Cement Association instructor, illustrating a point with one of the aggregate samples.

instructs the division's engineers and construction inspectors in the procedures to be followed in *any* portland cement concrete construction project. It stresses quality control, and emphasizes the importance of planning before concrete placement, inspection during placement, and inspection and alteration after placement.

New developments in concrete construction, now being used in California, are covered. These include new equipment and methods in central mixed concrete, slip form paving, experimental cements, pavement joints, cement treated base spreaders and bridge deck finishers.

After a tentative course outline was developed, two trial runs were held to test it. Then, a final "instructors syllabus" and necessary visual aids were prepared. Each district was asked to provide an instructor, who had both knowledge and practice in portland cement concrete paving, to help to teach the course in his district. A training meeting was held in Sacramento in November 1963 to train these instructors.

Taught in Each District

The course itself was taught in each district by an instructor team. This team comprised a representative of Headquarters Construction, the Bridge Department, the Division Training Section, and the Portland Cement Association. The district instructor joined the team for the presentation in his district, and was responsible for district arrangements and coordination. Each member of the team taught a part of the course, thus giving variety to the presentation.

Team members and district instructors were:

Portland Cement Association: J. A. Dobrowolski, R. H. Cooley, Warren H. Johnson and Gene Wirkus.

Headquarters Construction Department: Leigh S. Spickelmire.

Headquarters Training Section: Morris Redsun.

District 1: H. W. Benedict and Jim R. Kegler; District 2: W. R. Morrill; District 3: Leon R. Hawkes; District 4: Lloyd Fisk; District 5: Roy E.

Alderman; District 6: J. D. Roullard; District 7: Enrico Bissiri and Bob D'Alo; District 8: Hal Lee; District 9: Lloyd J. Hopper; District 10: R. K. Wells; District 11: John R. Cramer. Bridge Department: D. T. Swanson, L. L. Boulvare, Lloyd R. Johnson, O. N. Weston and L. J. Reese.

The basic method of instruction was informal illustrated lecture, using colored 35-mm. slides to depict various phases of highway construction. Classes were kept informal, and participants encouraged to ask questions at any time. After each hour of lecture, the class was formed into small groups. Each group met with an instructor who conducted a seminar to reinforce important points and to clarify any misunderstanding. Test equipment was demonstrated, exhibits were displayed and discussed, and participants were asked to relate what they had heard in the lectures to their actual jobs.

Motion Picture Mode

To present part of the material, a motion picture was developed, covering important testing procedures. It depicted the Kelly ball slump test, the air meter test, the unit weight test, the compressive strength (beam) test, and the washout test, as they are performed in the field. This motion picture was one of the best liked features of the program.

A pre and post test were used to evaluate how much the participants

Spickelmire conducting a "training the trainers" session.

Leon Hawkes, District 3, conducting a session on inspection procedures. Warren Johnson, Portland Cement Association, and Spickelmire await their turn to instruct. In the background are the test equipment and samples used to illustrate specific inspection and testing procedures.

learned. These measured how much more the participants knew about the subject after he took the course. On the average, students scored 30 percent higher on the post test than they did on the pre test. The pre test also helped to show the participant what they needed to learn about the subject, and thus motivated them to concentrate during the training.

Questionnaires Submitted

After completing the training, participants filled out and submitted unsigned questionnaires, which asked them how satisfied they were with the material, the presentation, application of the course to their job, and their personal development in the field of construction. Over 80 percent were well satisfied in each of these areas.

Each district now has a trained district instructor who can repeat any or all portions of the course. The motion picture and the course syllabus are available to them. New or newly assigned employees may be trained by the districts, and the districts can give refresher training to those who took the course, as needed. Thus, this course has become a part of our regular training curriculum for engineers.

San Mateo-Hayward Bridge

Construction of the new San Mateo-ayward Bridge has progressed to e point that work will soon begin the steel superstructure that crosses e navigation channel, it was an-ounced today by Robert B. Brad-rd, California State Highway Trans-rtation Administrator.

"The State advertised for bids on ugust 28," Bradford said, "and plans ll for the new bridge to be open traffic by mid-1967. Bids will be ened October 22, 1964, in San ancisco."

Bradford cited the fact that the thotropic design the State's engi-ers incorporated in the high-level perstructure will make this bridge e first of its kind in the U.S.A.

"Governor Brown, Chairman of the ate Toll Bridge Authority, wants is to be the best bridge that can be ilt," Bradford stated, "for he is are of its ever-increasing import-ce as a primary link in the transpor-ion system that connects the cities, mmunities and industrial complexes both sides of the San Francisco y.

"He also wants a bridge that is easing to look at. That is why the oll Bridge Authority approved the orthotropic concept on December 6, 1961, and why an outstanding architect, William S. Allen of San Francisco, was selected to advise our bridge engineers on aesthetics as design of the bridge progressed."

Because the development of orthotropic design, which permits steel plates rather than concrete roadway to act as the deck of a bridge and to also be part of the supporting girders, is new in this country, E. R. Foley, Chief, State Division of Bay Toll Crossings, traveled to West Germany last spring. There the orthotropic concept has been used in a number of bridges, and Foley commissioned one of the world's foremost authorities on bridge design, Hans Grassl of Düsseldorf, to review plans for the proposed California project.

Upon completion, the entire bridge will be 7.4 miles long and will incorporate 5,500 feet of orthotropic span construction. Included will be a central span 750 feet long, two 375-foot side spans, and series of spans 292 and 208 feet long. The 5,500-foot length will be the world's longest orthotropic bridge construction and the 750-foot central span the largest in the United States and third largest in the world.

The entire bridge will cost approximately $70 million. Foley predicts the superstructure bids will be in the "$25 million category."

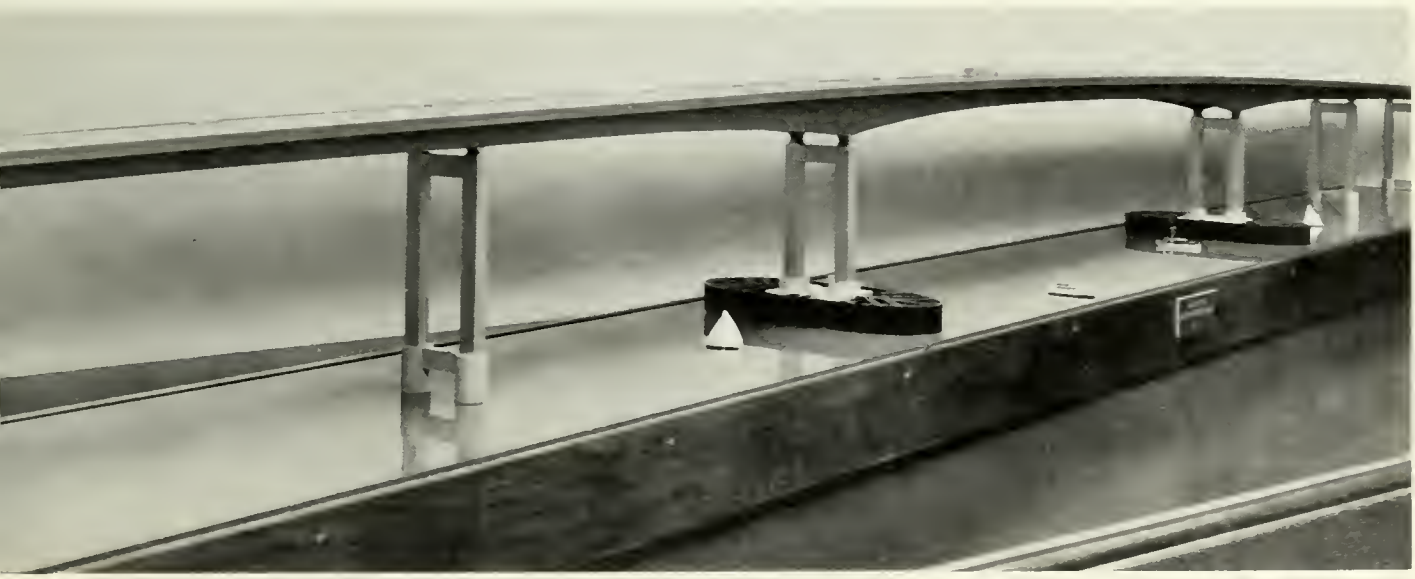
A contract let on July 5, 1963, for building substructures is now approximately half completed.

Average traffic on the present bridge located adjacent to the construction is 13,000 vehicles a day and increasing at the rate of 6 percent annually. The new structure is designed to carry 50,000 vehicles a day and will not reach its capacity until about 1995.

The present toll rate, 35 cents for an automobile, will also apply to the new bridge.

The 135-foot minimum clearance of the future structure will prove a benefit to drivers for it will permit oceangoing vessels to pass beneath at will. The present bridge is a lift type that must be raised several times a day as ships approach it.

When the four-six-lane bridge is opened to traffic, the existing two-lane bridge will be removed.



s model of the proposed new San Mateo–Hayward Bridge is on display at the Division of Bay Toll Crossings office at 151 Fremont Street in San Francisco.

Safety Glasses

Accident Dramatizes Importance of Program

A near accident which could have resulted in a loss of sight for Glen Thurman, welder at the California Division of Highways' Equipment Department, resulted instead in an award which was presented August 26.

Thurman received a membership in the Wise Owl Club, presented by Lyman R. Gillis, Assistant State Highway Engineer. Neal Andersen, Equipment Engineer for the Division of Highways, accepted a Wise Owl Club charter in behalf of the Equipment Department. The presentation was made by A. C. Macdonald, a member of the Board of Directors of the Sacramento National Safety Council.

The Wise Owl Club, an international organization established by the National Society for the Prevention of Blindness, Inc., is dedicated to preserving the sight of industrial workers. With nearly 30,000 members, the group is striving to eliminate the estimated 300,000 eye accidents which happen in industry each year.

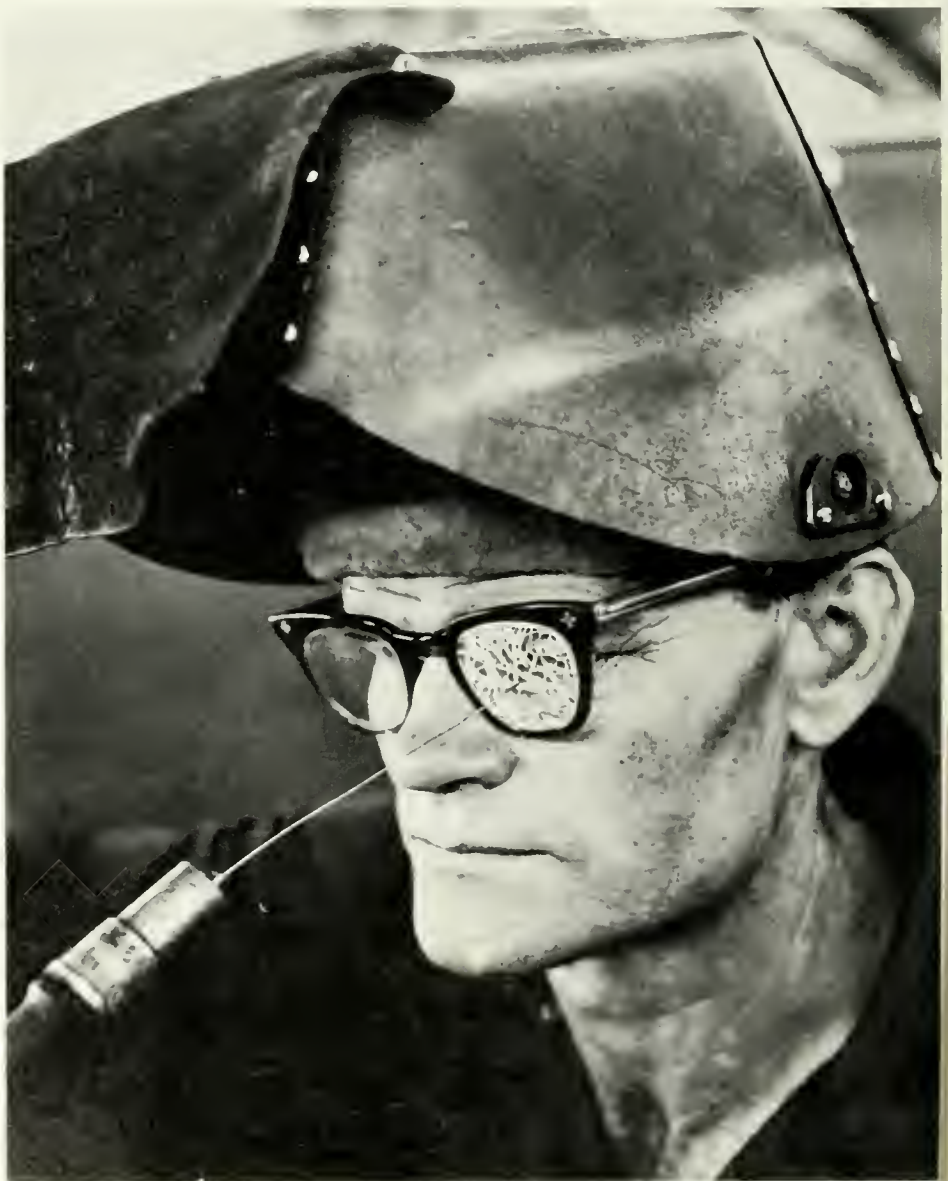
Thurman, wearing safety glasses provided by the State, escaped injury on July 21 when working with an argon gas welder. Malfunction of a rod ejection switch and tension built up in twisting cables caused the welding rod to uncoil with enough force to strike the left lens of Thurman's safety glasses. Evidence indicates that if eye protection had not been worn, the welding instrument would have penetrated Thurman's eye.

Pragram Established

In establishing its eye protection program the Headquarters Equipment Department considered the type of glasses, protective quality required, wearer acceptance, cost to the State and availability of replacement and repairs.

In determining the type of protection to supply shop employees, consideration was given to the type of potential injuries that may be encountered in the shop operations. It was found that the potential ranged from light dust and grease-laden dirt particles falling from the underbody of vehicles to the cutting force of a sharp chip of steel ejected from a metal-working machine. It was decided to protect against the heavy injuries by using a high-impact-resistance, tempered plano safety glass lens. This lens would also protect against the light foreign particles.

The type of frame was considered to be of major importance to wearer acceptance of the program. Plastic, smoke-colored frames with reinforced spatula temples were selected because of their strength, lightness, attractive appearance and similarity to standard frames supplied with regular prescription ground glasses.



Glen Thurmon, welder with the State Division of Highwoys equipment deportment, wears the safet glasses which saved his left eye from injury in reenactment of on accident which occurred while he wo operating o gos welding mochine.

Side Shields Considered

Side shields were considered. Although the protection was superior, it was decided not to use them. Anything gained by their use would be more than voided by the wearer resistance that could be expected to wearing an uncomfortable pair of glasses.

Uncomfortable and ill-fitting safety glasses will not be faithfully worn. In order to assure faithful wearing of the safety glasses and remove wearer resistance to poorly fitted glasses, arrangements were made for the supplier of the glasses to send his optometrist to the shop and individually fit each employee with a set of plano lens safety glasses.

The supplying of sturdy, attractive, well-fitted, plano lens safety glasses has resulted in almost universal acceptance by shop employees.

Before the installation of the eye protection program, eye injuries were approximately 25 percent of the shop total industrial injuries. Since the acceptance of the safety glasses by shop employees, approximately January 1, 1964, only one eye injury has occurred and it was a minor, no-lost-time, "foreign particle in eye" report.

Savings Result

In addition to the saving of Glen Thurman's eyesight, many less dramatic incidents have been experienced by shop employees. As evidenced by the practical elimination of eye injuries from Headquarters Shop accidents, the safety glass program is being well received and is effecting a savings to the State.

The average compensation payment for the loss of one eye in an on-the-job accident by a state employee of similar status is approximately $7,000. The entire cost of the Headquarters Equipment Department eye glass program was $237. This is a tax dollar saving of $6,763 through the prevention of injury in just this one instance.

The expansion of this program to include state-provided prescription ground safety glasses as well as plano lens safety glasses to all the Equipment Department shops would undoubtedly result in substantial savings in eye injury costs.

DRIVER OPINION POLL WILL BE COOPERATIVE PROJECT

Robert B. Bradford, administrator, Highway Transportation Agency (left); Earl F. Campbell, executive vice president, California Traffic Safety Foundation; and H. G. Vesper, president, Standard Oil Company of California, Western Operations, Inc., hold a Standard Oil check for a foundation grant for a special driver opinion study. The poll will be conducted by Field Research Corporation through the offices of the Department of Motor Vehicles.

A statewide opinion poll of drivers will soon be conducted in California through a cooperative effort of the California Traffic Safety Foundation and the Highway Transportation Agency, it has been announced by Robert B. Bradford, Agency Administrator.

The study, the first of its kind in California, was made possible by a special grant of funds from Standard Oil Company of California—one of the founding member companies of the foundation. The survey will be conducted by Field Research Corporation of San Francisco, according to Earl F. Campbell, foundation executive vice president.

One out of every five drivers being issued a driver's license in the field offices of the Department of Motor Vehicles during an undisclosed period will be asked to fill out a questionnaire covering traffic subjects, including opinions of driver education, ticket fixing, the handling of the drunk driver, legislation, police and courts. Motorists may also voice opinions of some of the things not being done.

The result will be the average driver's evaluation of present traffic safety programs and as constructive criticism may provide guides that will call for future changes.

"The California Traffic Safety Foundation is an excellent organization to conduct such a survey," Bradford said. "It does not necessarily represent the official state point of view. Rather, it is a citizen group not connected with state or local government in any way. It receives no governmental financing, but acts as a citizen sounding board to official programs.

"All of us in the agency were happy to cooperate with them."

Route Actions

Freeway Locations for Malibu, Other L.A. County Areas Chosen

The California Highway Commission adopted the locations for slightly more than 50 miles of new freeways on five routes at its July and August meetings.

Two of the routings followed public hearings by the commission itself. All of the adoption actions were preceded by district hearings in accordance with established policy.

Possibly the route adoption of greatest public interest was the one for approximately 22.2 miles of State Sign Route 1 (Pacific Coast Highway) in Los Angeles and Ventura Counties between Malibu Canyon Road and Point Mugu, which included a section through the Malibu Beach area.

It was the subject of a commission hearing held in Santa Monica on February 25, 1964.

The newly adopted route follows the general alignment of the existing highway from just west of Malibu Canyon Road westerly to just east of Corral Canyon Road, then swings slightly inland to Latigo Canyon Road, and continues westerly approximately three-quarters to one-quarter mile inland from the existing highway, rejoining the latter just west of Trancas Canyon Road.

It continues along the general alignment of the existing highway to the Point Mugu area except for a short stretch near the western limits of the adoption.

Recommended Route Changed

The commission varied from the route recommended by State Highway Engineer J. C. Womack in about seven miles near Malibu, locating the new facility as close as feasible to the foothills.

In recommending the variance, which will cost approximately $4,800,000 more than the recommended route, Commissioner Roger Woolley termed it "one that will permit better development of the Malibu Peninsula's coastal plain."

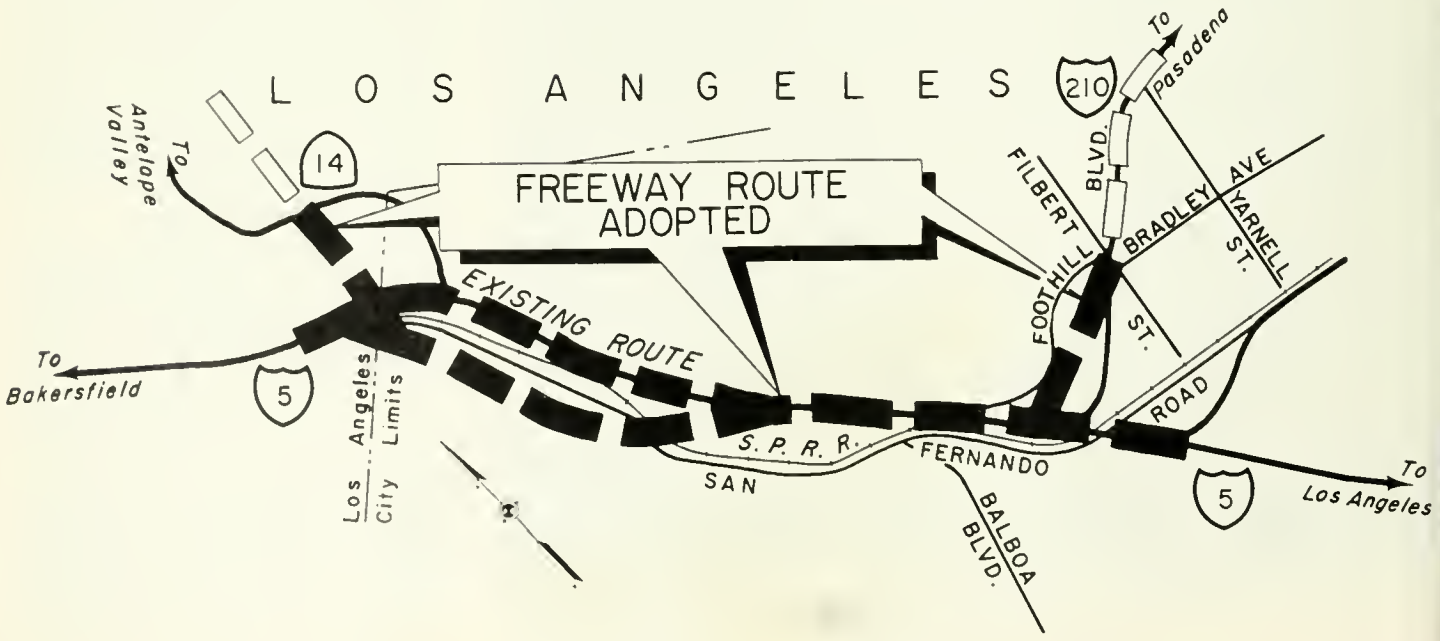
Plans of the Division of Highways call for the construction of a six-lane freeway with provision for expansion to eight lanes when required at an estimated cost of $41,600,000, including rights-of-way.

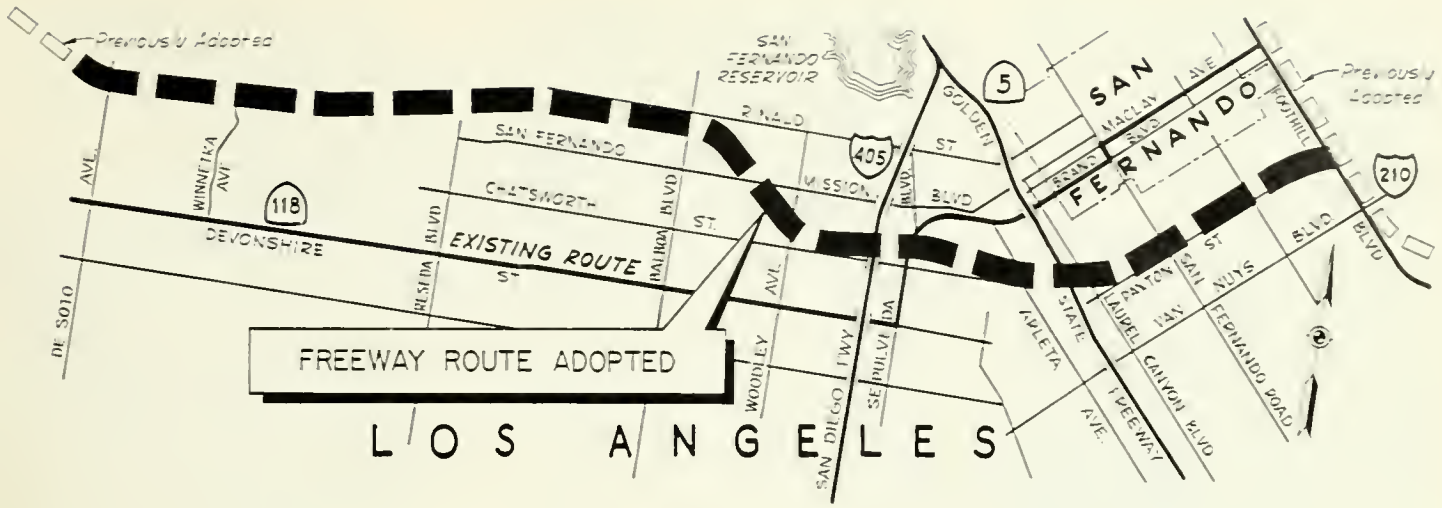
The second freeway route adoption following a commission hearing (San Fernando—July 9, 1964) was for 11.5 miles of State Sign Route 118 in Los Angeles County between 0.3 mile west of De Soto Avenue in Chatsworth and the adopted route for the future Interstate 210 Freeway near San Fernando.

Recommended by the State Highway Engineer, the new route runs easterly to beyond Winnetka Avenue, then northeasterly to where it is north of and adjacent to the Department of Water and Power's transmission lines south of Rinaldi Street. It continues east along this right-of-way, bending southeasterly east of Balboa Boulevard to east of Woodley Avenue, then easterly across the San Diego and Golden State Freeways.

It swings northeasterly beyond Laurel Canyon Boulevard, and continues north of and parallel to Paxton Street to join the adopted route of Interstate 210 just east of Foothill Boulevard.

The commission found that the adopted routing will affect 174 fewer





families while costing $2,900,000 less than the next most favored routing.

Less Disruption

Additionally, the commission's report stated that the adopted route will cause minimum disruption to the community and will provide good traffic service.

Plans of the Division of Highways call for the construction of an ultimate eight-lane freeway at an estimated most of $81,900,000, including rights-of-way.

In Madera County, the commission adopted the recommended 8.3-mile freeway routing for State Route 145 between 0.2 mile north of Avenue 5½ and the south city limit of Madera. This highway section is known locally as Madera Avenue.

The new route, positioned along the general alignment of the existing highway, connects on the south with a recently adopted routing for 6.7 miles to White Bridge Avenue in Kerman.

Two of the adoptions were revisions of previously adopted routings of Interstate 5 (US 99) in Los Angeles County.

One adoption, a 3.4-mile section north of San Fernando, is intended to provide separate roadways for automobiles and trucks.

It extends between 0.2 mile south of San Fernando Road and 3.2 miles northerly.

North Half for Trucks

The northern half will be reserved for truck traffic and a new route west of the existing alignment and the Southern Pacific Railroad tracks will be used for automobiles. On the southern half, autos and trucks will use the existing alignment but will have separate lanes for trucks.

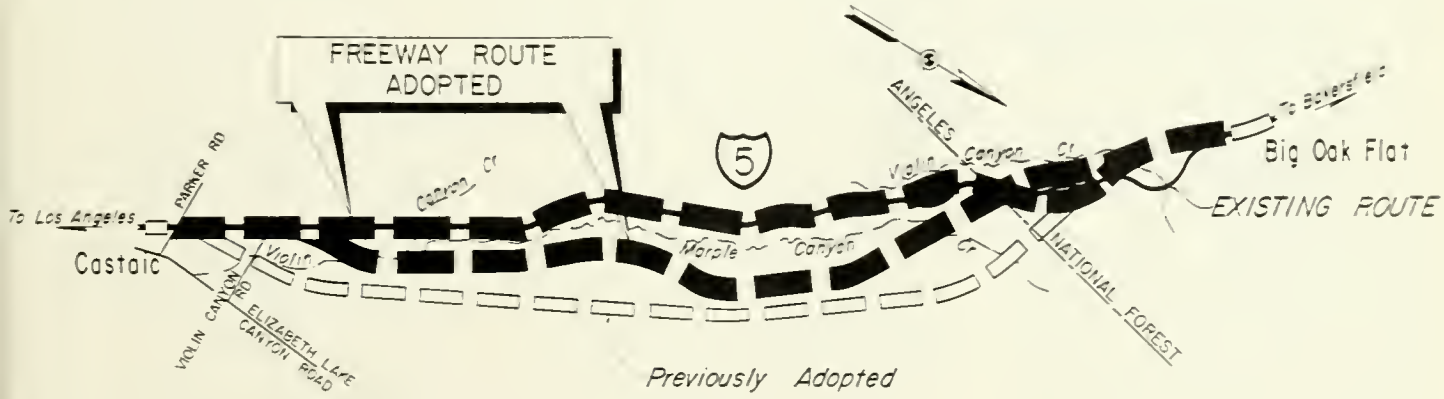
While revising this section of Interstate 5, the commission adopted freeway connections to State Sign Route 14 toward Antelope Valley and to the future Interstate 210 Freeway toward Pasadena.

The second revised adoption on Interstate 5 involves 6.8 miles north of Parker Road near Castaic.

The commission had adopted a freeway routing for a section of the Ridge Route between Parker Road and 17.9 miles northerly on April 25, 1962. The new revision affecting the southbound lanes in Marple Canyon was based on State Highway Engineer J. C. Womack's recommendation that $3,150,000 might be saved in construction and rights-of-way costs.

Womack had told the commission that this saving could be realized by shifting the routing for the southbound roadway somewhat to the west to fit the natural terrain.

The northbound (upgrade) roadway will continue to follow the alignment of the existing highway.



PARKS-HIGHWAYS TEAMWORK

September 2, 1964

Mr. J. C. Womack
State Highway Engineer
Division of Highways
Department of Public Works
1120 N Street
Sacramento, California

DEAR MR. WOMACK:

The fine work of one of your resident engineers, Milton Vlach, at our project in Alpine County has come to my attention. Our district superintendent, Clyde Newlin, reports that Mr. Vlach has worked very closely with our park supervisor and our District 3 engineering and landscape section to protect the natural scene and the tree growth in Grover Hot Springs State Park.

I do not mean to imply that this is a rare occurrence between our two organizations. I did want you to know, however, that both our supervisor and our district superintendent noticed this and commented on it specifically. We appreciate it a great deal.

I think it outstanding in relationships between two agencies of state government that, with 170 units in our state park system, we really have strong differences of opinion in only two, and with the miles and miles of state highway and state freeway in California, we probably have less than 10 miles of road alignment where there is any disagreement at all between our two organizations.

We will continue to work closely with you and with your district engineers in all cases to achieve satisfactory results before any major disagreements arise.

Sincerely,

Director
Department of Parks
and Recreation

INTERSTATE 40 JOB

The State Department of Public Works has awarded a $3,106,000 contract for constructing a four-lane divided freeway bridge to carry Interstate 40 (former US 66) across the Colorado River in the vicinity of Topock, Arizona, and southeast of Needles.

Motor Vehicle Total Will Hit 86,000,000

With an increase in both passenger car and truck registrations anticipated in every state, the nationwide motor vehicle registration in 1964 is expected to total 86,193,000, an increase of 3,493,362 over last year's 82,699,638, according to a report by Federal Highway Administrator Rex M. Whitton.

The estimated 4.2-percent rise over 1963's registration, Whitton said, reflects the nation's sustained high level of employment and the general economic activity.

The estimate, made by the U.S. Department of Commerce's Bureau of Public Roads, is based on state reports of registrations early in 1964, coupled with information on current trends, automotive production and other factors.

Passenger car registrations are expected to reach 71,864,000 this year, an increase of 4.2 percent above last year's 68,983,467. Commercial vehicles should rise to 14,329,000, a hike of 4.5 percent.

California with an estimated 9,531,000 vehicles will top all states followed by New York with 5,723,000, Texas 5,332,000, Pennsylvania 4,817,000, and Ohio 4,661,000. At the other end of the scale will be Alaska with 100,000 vehicles, Vermont 170,000, Wyoming 225,000, Delaware 229,000, and Nevada 263,000. Even though Nevada will be fifth from the bottom of the list, it will experience the largest percentage increase—8.2.

Several southern and western states will show substantial percentage increases. They are: Alabama, 6.3 percent; Arizona, 5.8; Arkansas, 5.2; Georgia, 5.9; Mississippi, 5.9; North Carolina, 5.2; Oregon, 5.4; and Texas, 5.2. A comparison of 1964 estimated registrations by states with 1963 actual registrations is shown on the back.

US 50 FREEWAY JOB

The State Division of Highways has called for bids on a major freeway job on US 50 about 20 miles east of Sacramento in El Dorado County.

The project calls for grading and paving 2.3 miles of four-lane freeway between two miles east of the Sacramento County Line and 1.2 miles east of Bass Lake Road, about 14 miles west of Placerville.

A total of $1,700,000 is available for the project.

SUTTER JR., NOT SR.

September 1, 1964

Mr. Karl Moskowitz
3836 Cresta Way
Sacramento, California

DEAR MR. MOSKOWITZ:

I was reading your article in the *California Highways and Public Works* magazine for July–August 1964, and found it very interesting.

However, on page 51, in the right-hand column, in the last paragraph on the page, I was surprised at an obvious error of fact that was allowed to escape previous notice.

The plain sentence from your article, "In 1850 Captain John Sutter laid out the City of Sacramento," appears.

All local historians agree that Captain Sutter founded his now famous fort in 1839. But likewise it is recorded that Captain Sutter was *not* the one who laid out Sacramento, but rather his son, John A. Sutter, Jr., is given that credit.

One of the most interesting books on the subject of early Sacramento (including Sutterville and Suttersville) is one that I had the privilege of working on while attending Sacramento Junior College: *John A. Sutter, Jr.: Statement of Early California Experiences*, edited with a biography by Allan R. Ottley.

This book can be secured readily, I am sure, at the State Library.

I trust that this information may prove helpful to you in any future writing, or even future publishing of your interesting article on auto-oriented cities.

Sincerely,

RONALD A. WARFORD
7261 Stanwood Way
Sacramento, California

Editor's Note:

Mr. Moskowitz informs us that Mr. Warford is right. John A. Sutter, Jr., not his father, laid out the street plan of Sacramento, and it was in 1849, not 1850.

Division Announces Latest Retired List

District I

Lloyd Gullick, highway maintenance man II, 15 years; Lawrence G. Hitchcock, highway maintenance man II, 32 years; Robert C. Hunt, highway maintenance man II, 42 years; Earl F. Mayeau, janitor, 6 years.

District II

Carl Burger, highway foreman, 28 years; Alfred T. Moore, highway engineering associate, 43 years; Bessie E. Peterson, bookkeeping machine operator II, 33 years; John W. Stone, highway foreman, 27 years.

District III

George W. Reed, assistant highway engineer, 9 years.

District IV

Joe Garabini, laborer, 20 years; Carl R. Goetz, assistant highway engineer, 16 years; H. Glover Hughes, associate highway engineer, 44 years.

District V

Carl A. Kaler, highway maintenance man III, 34 years; Bessie O. Ladd, highway field office assistant, 12 years.

District VII

Kathleen C. Busse, senior clerk, 15 years; Joe B. Hileman, highway maintenance man II, 31 years; Ruby M. Parsons, intermediate stenographer, 17 years; Allen Preston, associate highway engineer, 34 years; Mark Stan, groundsman, 5 years; James W. Sutton, senior highway foreman, 25 years.

District VIII

Almon B. Ruggles, associate right-of-way agent, 30 years; C. Clarke Waterman, accounting officer III, 25 years.

District IX

Fred McKenzie, highway maintenance man II, 17 years.

District X

Frank T. Lavagnino, highway maintenance man III, 30 years.

Joseph A. Caffrey

Joseph A. Caffrey, supervising right of way agent for California Division of Highways, died suddenly of a heart attack on August 11, while vacationing in Santa Cruz.

Caffrey had been appointed to service with the division's Right of Way Department in Marysville in 1947, and transferred to Headquarters in Sacramento in 1953. He had held his supervisory position since October of 1960, having had charge of approving right-of-way contracts pertinent to highway construction, and making final audits of title on transactions. He also worked on special studies for the right of way program.

Born in Sugar Notch, Pennsylvania, December 30, 1904, Caffrey attended schools in that state before going on to Fordham University in New York and then to Dickinson School of Law in Carlisle, Pennsylvania, where he received his degree in 1931. From then until 1937 he practiced law in Luzerne County, Pennsylvania, coming to California in 1938. He was successively employed by the City of Sacramento McClellan Air Force Base, and by the State Department of Motor Vehicles, before joining the Division of Highways.

He was a member of the American Right of Way Association.

Surviving Caffrey are his wife Mary, and four children—John, Antoinette, David, and Teresa.

Chief Draftsman Walt Landers Leaves

Senior Highway Engineer Walter Landers, chief draftsman for the State Division of Highways in Sacramento, retired August 31.

A native of Leigh, England, Landers attended school there and in Australia. He came to the United States in 1921.

From 1924 to 1928 he was a cartographer for Rand McNally & Company in San Francisco.

He started work for the Division of Highways as a draftsman in the Redding district office in 1928, advancing in subsequent years through drafting and engineering ranks. He transferred to Sacramento headquarters in 1938 and became chief draftsman in 1942.

WALTER LANDERS

In addition to his responsibilities for compiling division maps and maintaining records of maps and plans Landers has had the responsibility of assembling maps and plans prepared in other offices of the division for the letting of major construction contracts.

Landers is a member of the American Society of Civil Engineers. He is also a Mason and a member of the Shrine.

He and his wife, Agnes, have a son, Leslie, and a daughter, Barbara.

District XI

Morgan Bryce, highway foreman, 36 years; John W. Stone, highway foreman, 27 years.

Headquarters

Esther M. Cecil, accounting technician II, 29 years.

Materials and Research

Eldridge D. Drew, associate engineering geologist, 32 years; William W. Holtzclaw, skilled laborer, 18 years; James E. Kreiss, assistant physical testing engineer, 28 years.

Headquarters Shop

Frank T. Myers, heavy equipment mechanic, 29 years.

Shop 6

Herbert L. Carroll, highway mechanic foreman, 27 years.

Shop 8

Sidney J. Smith, mechanic's helper, 15 years.

Shop 11

Thomas F. Walsh, fusion welder, 17 years.

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JUSTIN DuCRAY . Departmental Management Analyst
S. ALAN WHITE . . Departmental Personnel Officer

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E. L. TINNEY . . . . . Maintenance Engineer
DONALD P. VAN RIPER . Principal Landscape Architect
J. E. WILSON . . . . . Traffic Engineer
A. L. ELLIOTT . . . . Bridge Engineer—Planning
R. J. IVY . . . Bridge Engineer—Special Projects
I. O. JAHLSTROM . . . Bridge Engineer—Operations
DALE DOWNING . . Bridge Engineer—Southern Area

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DEXTER D. MacBRIDE . . . . . Assistant Chief
R. S. J. PIANEZZI . . . . . Assistant Chief

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CLYDE P. BARNETT . . . . . Director, Chief of Division

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Remains of the old emigrant road (foreground) are still visible from this section of Highway 88 between Peddler Hill and Tragedy Springs. *(See "Highway 88" article beginning on Page 2)*

California Highways and Public Works
DIVISION OF HIGHWAYS
P O Box 1499
SACRAMENTO CALIFORNIA

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ANNUAL REPORT ISSUE

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California Highways and Public Works

Official Journal of the Division of Highways, Department of Public Works, State of California

Vol. 43 November–December Nos. 11–12

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LESTER S. KORITZ, *Editor*

STEWART MITCHELL, *Associate Editor* MARCIA J. MICKELSEN, *Assistant Editor*

WILLIAM R. CHANEY, *Chief Photographer*

Editors are invited to use information contained herein and to request prints of any black and white photographs.

Address communications to: EDITOR,

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

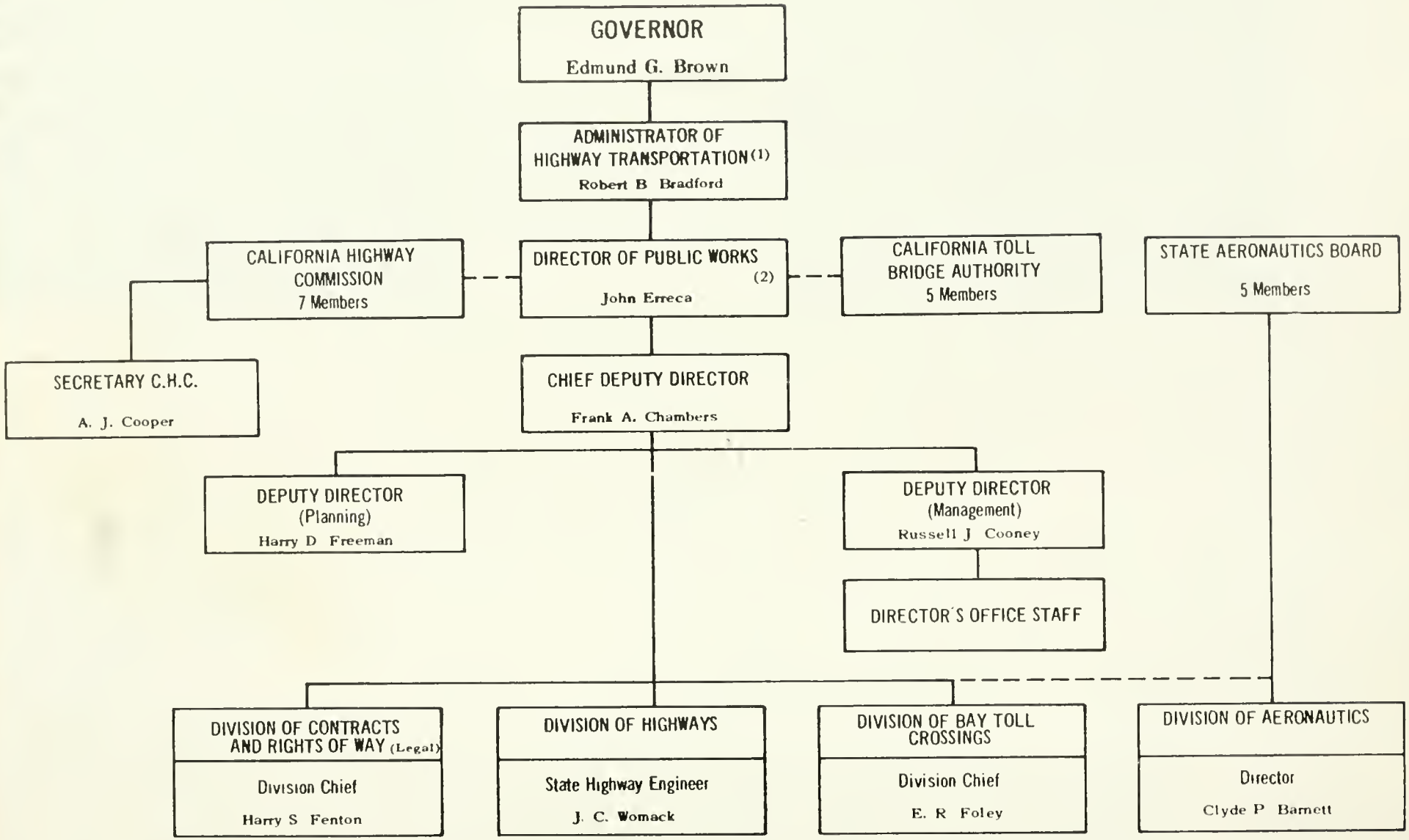
P.O. Box 1499

SACRAMENTO, CALIFORNIA 95807

FRONT COVER: In this aerial photo taken above Donner Pass, old US 40 winds down the eastern slope toward Donner Lake in the distance. The new Interstate 80 Freeway, opened to traffic on November 20, can be seen on the slopes to the left of the lake and beyond. (Photo by William R. Chaney).

BACK COVER: This nighttime view of the Antelope Road interchange on Interstate 80 near Sacramento displays the Division of Highways' latest devices aimed at keeping wrong-way drivers off freeways. The white-on-red signs which read WRONG WAY will be similarly placed on all off ramps in the State Highway system. The red pavement arrow (which is invisible to a driver clearing the ramp) and the sign, GO BACK—You Are Going—WRONG WAY, are still in the experimental stage and are now installed at a limited number of locations. (Photo by Bill Ruland.)

State of California
Department of Public Works – Organization Chart



(1) Administrator is Ex-officio Chairman and Member of the California Highway Commission and a Member of the California Toll Bridge Authority

(2) Director is Ex-officio Administrative Officer of the California Highway Commission and Administrative Officer of the California Toll Bridge Authority

NOVEMBER, 1964

STATE OF CALIFORNIA—DEPARTMENT OF PUBLIC WORKS

CALIFORNIA HIGHWAY COMMISSION

ROBERT B. BRADFORD, Chairman, Ex Officio

Member	*Residence*	*Date of original appointment*	*Term expires*
JAMES A. GUTHRIE	San Bernardino	September 14, 1943	January 15, 1965
ROGER S. WOOLLEY	Rancho Santa Fe	March 18, 1959	January 15, 1967
ABRAHAM KOFMAN	Alameda	September 14, 1961	January 15, 1964
FRANKLIN S. PAYNE	Los Angeles	February 3, 1962	January 15, 1966
WILLIAM S. WHITEHURST	Fresno	April 25, 1963	January 15, 1965
JOSEPH C. HOUGHTELING	Sunnyvale	November 28, 1964	January 15, 1967

Administrative Officer: JOHN ERRECA

Secretary: A. J. COOPER

Assistant Secretary: ROBERT T. MARTIN

CALENDAR OF MEETINGS

CALIFORNIA HIGHWAY COMMISSION

July 1, 1963, to June 30, 1964

July 18, 19 and 20, 1963 — Crescent City
Inspection of state highways and dedication ceremonies for the Randolph Collier Tunnel

July 22 and 23, 1963 — Sacramento

August 20 and 21, 1963 — Sacramento

August 22, 1963 — San Francisco

August 23, 1963 — Antelope Valley
Inspection of state highways and dedication ceremonies for the Antelope Valley Freeway

September 10, 1963 — Coronado

September 11, 1963 — San Diego

September 24, 1963 — Chico
Inspection of state highways and dedication ceremonies of the freeway through Chico

September 25 and 26, 1963 — Sacramento

September 28, 1963 — San Pedro
Inspection of state highways and dedication ceremonies of the Vincent Thomas Bridge

October 10, 1963 — Hayward
((Public hearing, Road IV-Ala-105-Hay, between Route 69 and Route 5 (freeway) near Hillary Street and Road IV-Ala-259-Hay,A, between Route 5 (freeway) near Hillary Street and Route 5, 0.7 mile east of Crow Canyon Road))

October 30, 1963 — Sacramento

October 31 and November 1, 1963
Inspection of state highways in Sierra, Plumas, Lassen and Modoc Counties

November 20, 1963 — Lompoc
Inspection of state highways in the vicinity of Santa Maria, Lompoc and Vandenberg Air Force Base

November 21, 1963 — Los Angeles

December 11, 1963 — San Francisco
(Public hearing, Road IV-SM, SF-253-Bsbn,SF between Route 68, 0.6 mile south of the San Francisco-San Mateo county line and Route 253 near Evans Avenue in San Francisco)

December 18, 1963 — Sacramento

January 23, 1964 — Sacramento

January 24, 1964 — Sacramento
(Joint session with the State Park Commission)

February 24, 1964 — Santa Monica
Inspection of alternatives for the freeway in Malibu area

February 25, 1964 — Santa Monica
(Public hearing, Road VII-L.A., Ven-60-A,A, between Malibu Canyon Road and Calleguas Creek)

February 26, 1964 — San Bernardino

February 27, 1964 — Palm Springs
Inspection of state highways and review highway problems in the central Riverside-San Bernardino County area

March 12, 1964 — Hopland
((Public hearing, Road I-Men-1-L,B, between 0.6 mile south of the Hopland Overhead and Crawford Ranch and Road I-Men-16-A, between Route 1 (new) and 0.1 mile east of Dooley Creek))

March 19, 1964 — Sacramento

March 20, 1964 — Fresno
(Public hearing, Road VI-Fre-125-Fre,C, between "M" Street in the City of Fresno and 1.0 mile south of the Madera county line)

April 15, 1964 — Sacramento

April 16, 1964 — Folsom
(Public hearing, Road III-Sac,Pla-249-C,D;A,Rsv,A, between one-half mile south of Grant Line Road and Rocky Ridge Road)

May 20, 1964 — Sacramento

May 21, 1964 — San Francisco
(Public hearing, Road IV-SF-223-SF, between Route 2 near Haight and Octavia Streets and Route 56 near Golden Gate Park; Road IV-SF-56-SF, between Route 223 near Golden Gate Park and Route 2 on the Golden Gate Bridge approach; and Road IV-SF-2-SF, between Route 2 near McAllister and Franklin Streets and Route 2 on the Golden Gate Bridge Approach)

June 24, 1964 — Oakland

June 25, 1964 — Willows
Inspection of the Mendocino Pass Highway

PAST MEMBERS OF THE CALIFORNIA HIGHWAY COMMISSION

Name	Residence	Date of appointment	Termination of membership
Burton A. Towne	Lodi	Aug. 2, 1911	Resigned Jan. 14, 1914
Charles D. Blaney	Saratoga	Aug. 2, 1911	Resigned Mar. 1, 1917
N. D. Darlington	Los Angeles	Aug. 2, 1911	Resigned Jan. 8, 1923
Charles F. Stern	Eureka	Jan. 15, 1914	Resigned Dec. 21, 1918
Henry J. Widenmann	Vallejo	Mar. 1, 1917	Died Oct. 6, 1918
Charles A. Whitmore	Visalia	Nov. 29, 1918	Resigned Jan. 8, 1923
Emmett Phillips	Sacramento	Dec. 21, 1918	Died June 18, 1919
George C. Mansfield	Oroville	June 24, 1919	Resigned Jan. 9, 1923
Harvey M. Toy	San Francisco	Jan. 9, 1923	Resigned Jan. 3, 1927
Louis Everding	Arcata	Jan. 9, 1923	Resigned Jan. 17, 1927
Nelson T. Edwards	Orange	Jan. 10, 1923	Resigned Jan. 3, 1927
Ralph W. Bull	Eureka	Jan. 6, 1927	Resigned Jan. 6, 1931
J. P. Baumgartner	Santa Ana	Jan. 6, 1927	Resigned Jan. 6, 1931
M. B. Harris	Fresno	April 18, 1927	Resigned Jan. 6, 1931
Joseph N. Schenck	Los Angeles	Aug. 19, 1927	Resigned Jan. 6, 1931
Fred S. Moody	San Francisco	Aug. 19, 1927	Resigned Jan. 6, 1931
Earl Lee Kelly	Redding	Jan. 6, 1931	Died Nov. 1, 1962
Frank A. Tetley	Riverside	Jan. 6, 1931	Resigned July 31, 1935
Timothy A. Reardon	San Francisco	Jan. 6, 1931	Resigned May 7, 1936
Harry A. Hopkins	Taft	Jan. 6, 1931	Resigned Oct. 14, 1937
Philip A. Stanton	Anaheim	Jan. 6, 1931	Resigned Mar. 3, 1939
Dr. W. W. Barham	Yreka	Dec. 20, 1932	Resigned May 21, 1935
Ray Ingels	Ukiah	May 21, 1935	Resigned Oct. 4, 1935
C. D. Hamilton	Banning	Aug. 1, 1935	Died April 24, 1936
H. R. Judah	Santa Cruz	May 7, 1936	Resigned Oct. 5, 1937
Paul G. Jasper	Fortuna	May 7, 1936	Resigned Mar. 3, 1939
William T. Hart	Carlsbad	July 7, 1936	Resigned Mar. 3, 1939
Robert S. Redington	Los Angeles	Oct. 5, 1937	Resigned Jan. 27, 1939
Frank W. Clark	Los Angeles	Jan. 27, 1939	Resigned Mar. 10, 1939
Lawrence Barrett	San Francisco	Mar. 3, 1939	Resigned Jan. 11, 1943
Iener W. Nielsen	Fresno	Mar. 3, 1939	Resigned Jan. 11, 1943
Amerigo Bozzani	Los Angeles	Mar. 3, 1939	Resigned Jan. 11, 1943
Bert L. Vaughn	Jacumba	Mar. 3, 1939	Resigned Jan. 11, 1943
L. G. Hitchcock	Santa Rosa	Mar. 10, 1939	Resigned Jan. 11, 1943
Gordon H. Garland	Sacramento	Jan. 11, 1943	Resigned Sept. 14, 1943
Mrs. Dora Shaw Heffner	Sacramento	Jan. 11, 1943	Resigned Sept. 14, 1943
Miss Helen MacGregor	Sacramento	Jan. 11, 1943	Resigned Sept. 14, 1943
Verne Scoggins	Sacramento	Jan. 11, 1943	Resigned Sept. 14, 1943
William Sweigert	Sacramento	Jan. 11, 1943	Resigned Sept. 14, 1943
C. Arnholt Smith	San Diego	Sept. 14, 1943	Resigned Jan. 1, 1949
C. H. Purcell	Sacramento	Sept. 14, 1943	Resigned July 31, 1951
Homer P. Brown	Placerville	Sept. 14, 1943	Resigned Oct. 26, 1951
Harrison R. Baker	Pasadena	Sept. 14, 1943	Jan. 15, 1954
Charles T. Leigh	San Diego	May 11, 1949	Jan. 15, 1955
F. Walter Sandelin	Ukiah	Sept. 14, 1943	Jan. 15, 1956
Frank B. Durkee	Sacramento	Aug. 4, 1951	Resigned Dec. 31, 1957
H. Stephen Chase	San Francisco	Oct. 30, 1951	Resigned Feb. 25, 1958
Fred W. Speers	Escondido	Jan. 21, 1955	Jan. 15, 1959
C. M. Gilliss	Sacramento	Jan. 1, 1958	Resigned Nov. 10, 1958
John O. Bronson	Sacramento	Feb. 26, 1958	Jan. 15, 1959
T. Fred Bagshaw	Mill Valley	Nov. 10, 1958	Resigned Jan. 4, 1959
Robert L. Bishop	Santa Rosa	Jan. 15, 1956	Jan. 15, 1960
Chester H. Warlow	Fresno	Sept. 14, 1943	Jan. 15, 1961
John J. Purchio	Hayward	Jan. 15, 1960	Resigned Sept. 9, 1961
Robert E. McClure	Santa Monica	Jan. 18, 1954	Jan. 15, 1962
John Erreca	Los Banos	Jan. 16, 1961	Sept. 20, 1963
Arthur T. Luddy	Sacramento	Feb. 16, 1959	Resigned July 31, 1964
Alfred E. Heller	Grass Valley	July 17, 1964	Resigned Nov. 26, 1964

PHOTO RIGHT: Shown is an interchange near completion in West Los Angeles, connecting the Interstate 10 (Santa Monica) Freeway, crossing from left to right, and the Interstate 405 (San Diego) Freeway. Interstate 10 is completed or under construction between the East Los Angeles Interchange and the Pacific Coast Highway (Route 1) in Santa Monica.

California Highways...1964

California's highway progress was spotlighted in 1964 by a significant anniversary date—in September it was just 25 years since the enactment of the state's first freeway law.

What the Legislature did in 1939 was to adopt a series of additions to the Streets and Highways Code which, first, defined a freeway as a highway to which owners of abutting property had no right or easement of access or only limited or restricted access; second, authorized the Department of Public Works to lay out, acquire and construct freeways; third, provided for purchase or condemnation of access rights, with compensation; and, fourth, required agreements between the state and local governments for street and road closures incidental to freeway construction.*

* *Editor's note:* The story of the 1939 legislation is fully told in "The Freeway Law," by Frank B. Durkee, in the September–October 1964 issue of *California Highways and Public Works.*

This legislation, the foundation on which California's rapidly growing freeway network has taken shape, protected the state's investment in highway construction from the encroachments of uncontrolled roadside developments that sooner or later choke any major traffic artery, multiply accidents and often defeat the very purpose for which the facility was built.

Legislative concern for highway development in California is based on the

A 5.9-mile section of the Redwood Parks Freeway (US 101) in Humboldt County south of Miranda was completed in October, which together with a 2.6-mile section under construction near Sylvandale and a 7.7-mile unit to be advertised for bids this winter north of Englewood, will complete 33 miles of full freeway on this route south of Scotia.

The 1,500th Mile . . .

This four-lane freeway section of Interstate 15, in the Mojave Desert about midway between Barstow and the Nevada state line, is part of a recently completed 17-mile project which carries California's total of full freeways past the 1,500th-mile mark. An 18-mile project northeasterly of this section will be finished in early 1965, completing full freeway between the Nevada line and Barstow, and freeway and expressway to San Bernardino.

facts of the state's history and development. California's era of greatest growth came after the peak of railroad expansion had passed; half of the state's communities lack rail service of any kind. Safe, high-capacity highways were essential if people and goods were to move freely through California's 825-mile length.

Twenty years after the pioneering freeway law, the Legislature looked again to the state's future and adopted a master plan for a statewide system of freeways and expressways. This 1959 law was based on a comprehensive study which the Legislature had ordered in 1957.

One of the most significant features of the freeway system study was the breadth of cooperation by state, county and city officials—planners as well as engineers. Not only did an advisory committee of seven county and seven city officials assist the department, but a number of the counties and cities, in cooperation with the Division of Highways, also drafted their own comprehensive traffic plans, the results of which were used in preparing the final freeway system proposal.

The system as enacted by the Legislature in 1959 contained 10,722 miles already in the state highway system and 1,519 miles then under local jurisdiction. Routes subsequently added have brought the total to 12,414 miles. Freeway routings adopted by the Highway Commission now total more than 7,100 miles.

This statewide system, the first in the nation, will connect all cities of 5,000 or more people, and will serve every major industrial, agricultural, commercial and recreational region. It will be substantially completed by 1980.

The system will be reviewed by the Legislature early in 1965 and every four years thereafter to keep it in line with possible changes in traffic conditions.

As specified in the 1939 legislation, control of access is the hallmark of a freeway. Thus, the 1959 master plan encompasses a substantial mileage of freeways which are only two lanes wide—at present—but which have built-in provision and sufficient right of way for additional lanes when needed and feasible; and additional mileage of multilane expressways, which have a median divider between the roadways but on which there may be some cross traffic still at grade.

Most of the recent and current construction on heavily traveled routes, however, has been initially of the "full freeway" type. This is a multilane divided highway with not only full control of access but also with all cross traffic carried over or under the freeway.

At year's end, of the 2,940 miles of multilane divided highways opened to traffic, 1,589 miles were constructed to full freeway and 733 miles to expressway standards. Another 745 miles of freeways and 61 miles of expressways are under construction or budgeted.

Completed multilane expressway mileage is 28 less than that of last year, reflecting conversion of expressway sections to full freeway standards.

Additionally, 918 miles of two-lane expressways, mostly in rural and mountain areas, are completed, under construction or budgeted.

Having more than one-ninth of the nation's registered motor vehicles, Californians today drive more than 82 billion miles a year. By 1980 this figure will increase to 200 billion. But, thanks to the freeway and expressway system, a network that will constitute only one-tenth of the state's total road mileage but will carry 60 percent of all traffic—leaving the remaining nine-tenths of the mileage composed of streets, county roads and conventional state highways to carry only 40 percent—highway officials are confident that there will be less traffic congestion in 1980 than exists today.

The Interstate System

The 41,000-mile national system of interstate and defense highways, the largest construction project in history, will link the principal metropolitan areas and industrial centers of all the states but Hawaii and Alaska by high-capacity ultrasafe freeways.

California's portion of this network, a system within and totaling approximately 17.5 percent of the state's freeway and expressway system, is 2,178 miles, of which routings have been adopted for all but 18 miles.

A total of 701 miles are now completed and another 527 miles are under construction or budgeted. An additional 169 miles are in operation as expressways but will be upgraded to full freeway standards by 1972.

The percentage of completed mileage might be misleading in the light of the 1972 deadline. However, the Highway Commission and Division of Highways have emphasized early completion of the most expensive mileage in densely populated metropolitan areas, plus difficult stretches in the mountains and deserts, where the greatest traffic relief could be afforded, before tackling some of the less complicated sections through rural areas.

This state leads the nation in the amount of interstate system funds expended, obligated or budgeted—$2,275,000,000 counting projects in the 1965-66 budget—and is among the leaders in the amount of rights-of-way purchased.

Traffic Safety

Many traffic safety programs are underway. They are needed. In 1963, 4,318 people were killed and another 200,000 injured in traffic accidents in California. Property damage was estimated at $750,000,000.

Highway safety research programs range from investigations into all causative factors for negligent driving to studies of roadway design. But the most important single thing being done to combat the appalling accident rate is the replacement of conventional highways with controlled access freeways.

An eight-lane freeway section near the summit of the Ridge Route (Interstate 5) between Kern and Los Angeles Counties was completed this fall, extending the Grapevine Grade Freeway (completed in 1960) 4.7 miles southerly.

A newly budgeted Interstate 680 Freeway project will extend this completed freeway south of Scotts Corner in Alameda County to one mile north of the Contra Costa county line. Projects under construction or budgeted will provide full freeway between Fremont in Alameda County and Vallejo in Solano County on this bay area circumferential route.

The above photo of experimental signs installed this summer at an Interstate 80 Freeway off-ramp northeast of Sacramento indicates the Division of Highways' concern with the "wrong way" driver.

Every day more than one life is spared and 65 persons saved from injury by the safety factors built into California freeways. These are deaths and injuries which would occur if the freeways did not exist and if the same travel had taken place on conventional highways.

In 1962 and 1963, the accident rate on urban conventional highways was 5.29 per million vehicle-miles—on urban freeways, 1.57. On rural conventional highways during the same period, the accident rate was 2.43—on rural freeways, 0.97.

The fatality rate on urban conventional highways, per 100 million vehicle-miles, during those years was 4.03—on urban freeways, 2.73; on rural conventional highways, 9.10—on rural freeways, 4.52.

Other Benefits

Although statistics showing the reduction in traffic deaths and accidents resulting from the use of freeways are fairly well known, many people are less aware of the wide range of other benefits. These include lowered costs for insurance, fuel and equipment, and tremendous savings in travel time.

The Automobile Club of Southern California two years ago studied its employees' travel time to and from home in metropolitan Los Angeles during peak traffic hours. This travel took place not only on freeways but also on conventional highways and city streets.

It was found that travel speeds averaged 30.5 miles per hour in 1962, contrasted with 26 miles per hour in 1960 and 24 in 1957.

This significant decrease in travel time was ascribed to the completion of freeway segments which relieved traffic on alternate routes as well as expediting heavy volumes of traffic themselves.

The speedup of travel time, important as it is to the individual motorist, if of far greater significance in commercial operations. The cost of retail goods at the point of purchase reflects the cost of delivery from the manufacturer or wholesale outlet.

Operating costs of private motor vehicles are more than a half-cent a mile less on freeways in fuel and upkeep than on conventional highways and city streets. Trucks and motorbuses realize far greater savings.

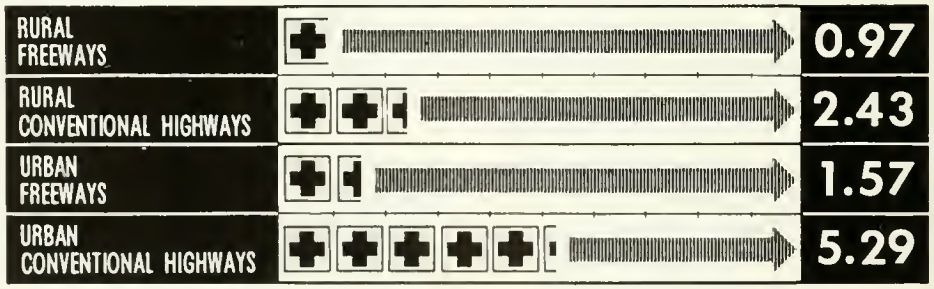
Community Effects

Shifting travel from "Main Street" to the new freeway facility gives the former back to the merchants and their customers, who, before, were prevented by traffic congestion from parking and shopping. Heavy through traffic is normally unproductive of sales, yet the local shopper—the mainstay of an area's business—frequently

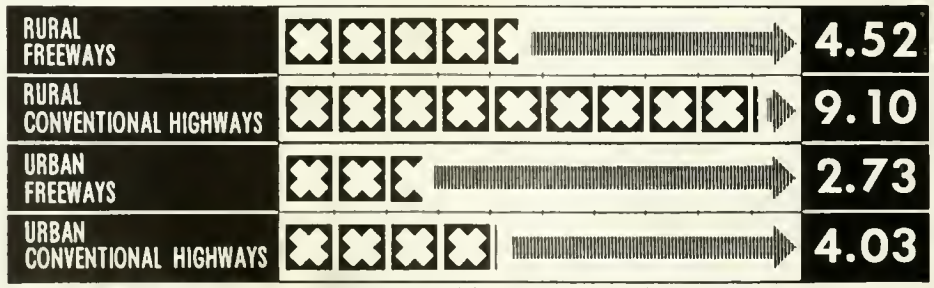
FREEWAYS and SAFETY

(1962-63 AVERAGES)

ACCIDENT RATE PER MILLION VEHICLE MILES



*FATALITY RATE PER 100 MILLION VEHICLE MILES



*Refers to numbers killed as distinguished from number of fatal accidents

was forced farther and farther away to outlying shopping centers or even neighboring towns by the pressure of nonstopping vehicles.

Community residents discover that the opening of a paralleling freeway removes most of the exhaust fumes and bothersome noise associated with the older highway through town. The older route, superseded as a state highway by the freeway and relinquished to the community, no longer acts as a barrier, fearsome and time-consuming to cross.

Since freeways reduce time-distance factors and transportation costs, they make communities more attractive to industries seeking sites for relocation or expansion. Equally important, they offer the area's working force greater areas in which to market its skills.

National studies of the sale prices of homes by the U.S. Department of Commerce have been confirmed by similar studies by the Research and Development Section of the Division of Highways Right of Way Department. Both show that the sale prices of homes adjacent to modern landscaped freeways generally are comparable to homes a few blocks away.

Shown is a section of two-lane expressway on Route 299 northeast of Adin in Modoc County completed in midyear.

The California Highway Commission

The Legislature established the California Highway Commission in its present form in 1943 to insure not only continuity of highway policy, but also its removal from sectional or political considerations.

Its membership comprises six business and professional men, appointed by the Governor and confirmed by the Senate, plus, as its chairman, the Administrator of the Highway Transportation Agency. The State Director of Public Works serves as its administrative officer.

The six members serve without pay for four-year staggered terms. They are required by law to represent the entire state rather than a particular area.

The commission's duties include the budgeting and allocating of state highway funds, the determining of routings for freeways and other highways, and the approval of select systems of county roads and city streets, the authorizing of condemnation proceedings, and approving the terms and conditions of deeds and right-of-way relinquishments and abandonments.

The commission adopts an annual budget each October for the coming fiscal year. For fiscal year 1965–66, it budgeted $612,432,000 for state highway construction purposes, including rights-of-way and engineering. However, to insure that all savings from individual projects can be made available quickly for other work, it adjusts budgeted amounts at its regular monthly meetings.

The Division of Highways

The Division of Highways, a unit of the Department of Public Works, is an organization of career employees chosen and promoted on the basis of competitive examinations. It is responsible for the actual operation of the highway program including planning, design, right-of-way acquisition, construction and maintenance.

Its chief, the State Highway Engineer, is assisted by a headquarters staff in Sacramento and by 11 highway district engineers and their staffs who are responsible for all aspects of the highway program in their areas.

Experience has shown that this decentralization makes the program more responsive to local conditions and needs.

Information on local highway matters may best be obtained from the following, their areas delineated by the accompanying map:

District 1—Sam Helwer, District Engineer, 430 West Wabash Avenue, Eureka

District 2—H. S. Miles, District Engineer, 1657 Riverside Drive, Redding

District 3—W. L. Warren, District Engineer, 703 B Street, Marysville

District 4—Alan S. Hart, District Engineer, 150 Oak Street, San Francisco

District 5—R. J. Datel, District Engineer, 50 Higuera Street, San Luis Obispo

District 6—W. L. Welch, District Engineer, 1352 West Olive Avenue, Fresno

District 7—E. T. Telford, District Engineer, 120 South Spring Street, Los Angeles

District 8—C. V. Kane, District Engineer, 247 Third Street, San Bernardino

District 9—C. A. Shervington, District Engineer, South Main Street, Bishop

District 10—J. G. Meyer, District Engineer, 1976 East Charter Way, Stockton

District 11—J. Dekema, District Engineer, 4075 Taylor Street, San Diego

Highway Financing

Based firmly on pay-as-you-go highway-user taxes which provide such fairly predictable sources of revenue as gasoline and diesel fuel, drivers' licenses and registration fees, weight fees on commercial vehicles, and taxes on for-hire trucking, California's highway program can be planned many years in advance.

The accompanying chart shows the sources and expenditures of all revenues received.

California's Constitution requires that revenues from highway-user taxes be used for road construction and maintenance, and the administration of the Division of Highways, the Department of Motor Vehicles and the Highway Patrol.

Federal monies stemming from the U.S. government's taxes on the highway user are returned to the state according to complicated formulae. More than 91 percent of the cost of constructing the state's portion of the interstate system is recompensed from federal funds, as is 58 percent of the amount spent on certain federal-aid primary, secondary and urban highway projects.

The Highway Commission is required by law to allocate 55 percent of construction funds to the 13 southern counties and 45 percent to the remaining 45 counties each year. The law further requires certain minimum expenditures in each highway district, including a minimum of $4,000,000 in each county over each four-year period, except in sparsely populated Alpine and Sierra Counties, where this minimum is $1,000,000.

Freeway Route Selection

The Legislature, not the Highway Commission, designates routes as state highways, both freeway and conventional, and fixes their general termini. It sometimes specifies certain general control points through which they must pass. It remains for the Highway Commission, however, to determine specific routings.

Like the old-time policeman on the beat, the local district highway engineer knows the area for which he is responsible. When he finds that freeway location studies are indicated, he obtains authority to make them from the State Highway Engineer.

Governing bodies of cities and counties are informed at the start of such studies. Both are asked to cooperate and to provide available information on any master plan for transportation and development of the area concerned.

The district engineer's staff develops several feasible alternates, considering the destination desires of motorists, community plans for land use, the controls imposed by terrain and other factors, the effect of each alternate on individual properties and on community values, and the relative costs for construction and right-of-way acquisition.

All concerned—interested agencies of federal, state and local governments, water and school districts, and utility and transportation companies, among others—are consulted during the development of the several alternates. All alternates under study are mapped and fully discussed at public hearings at which area residents are urged to express their views.

When the completed report of route studies is received by the State Highway Engineer, he reviews and analyzes it and recommends a routing to the Highway Commission. The commission, however, never adopts a routing without informing the local governing body of its intention to do so and asking if a public hearing by the commission itself is desired. On occasion, it will set a hearing date without such a request when it determines that a hearing would be in the public interest.

STATE HIGHWAY DISTRICTS

The route finally chosen is that which the commission considers will best serve the general public, taking all factors into consideration.

Cooperation continues between the state and local government following route selection. Representatives of both negotiate a freeway agreement covering local street and road adjustments necessitated by the new freeway facility.

Right-of-way Acquisition

Agents of the Right of Way Department of the Division of Highways rightly regard themselves as working both for the state and for the affected property owner.

To permit intelligent planning by those whose properties will be required by freeway construction, agents visit affected residents to explain acquisition procedures, as soon as design studies are sufficiently advanced to identify properties in the freeway's path.

Property appraisal is always based on "fair market value," defined by the courts as "the highest price in terms of money which the land (property) will bring if exposed for sale in the open market with a reasonable time to find a purchaser, buying with full knowledge of all the uses and purposes to which it is adapted and for which it is capable of being used."

In fairness to all, the appraisers consider only objective factors and are completely uninfluenced by bargaining procedures.

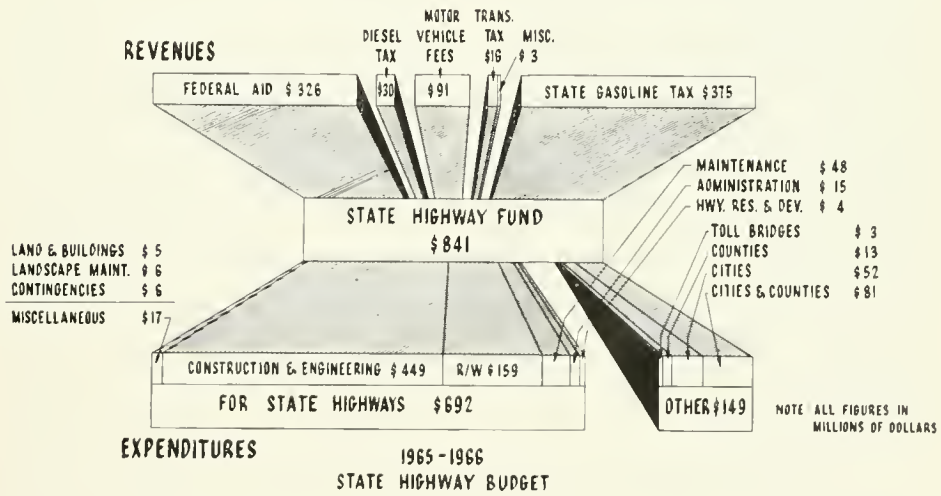
During the past fiscal year, the Right of Way Department acquired 7,333 properties for highway construction purposes. In these transactions, the owners of 96.1 percent of the parcels involved accepted the state's offer of settlement. Only 3.9 percent were acquired by court action in eminent domain proceedings.

In acquiring rights-of-way, not only does the state pay cash but no real estate commissions or title costs and document fees are involved. Additionally, the U.S. Internal Revenue Service does not tax income or capital gains on the increase in the sale price above original cost when properties are sold to governmental agencies for public purposes, provided that the money received is used to purchase similar properties within specified time limits. U.S. Veterans Administration and California Department of Veterans' Affairs' loans may be transferred to the new properties.

Shown is a portion of the 11.3-mile freeway section of US 101 between south of San Ardo and north of Bradley in Monterey County which was completed in August. This section connects on the south with a 6.7-mile freeway project, which will be opened to traffic next fall. The latter, in turn, connects with a recently completed 4.8-mile freeway section extending to north of San Miguel in San Luis Obispo County.

Route Renumbering

Senate Bill 64, providing for the renumbering of the state highway system, became effective July 1, 1964.



This visto point is on on eight-mile freeway section of US 101 north of Arcata, completed in late October. This stretch olong the beoch provides the first view on this route of the Pocific Oceon north of Son Francisco. In distance is Trinidod Head.

This legislation decreed that there be only one route number for each highway section, with minor exceptions at locations where certain routes are coincident for short distances. Formerly, many routes were known by several different numbers – legislative, state sign route, U.S. sign route, and, more recently, by numbers on the interstate system.

In establishing the new numbering, precedence was given to retention of present sign route numbers in the following order: interstate routes, U.S. numbered routes, and state sign routes.

Every effort was made to retain numbers on existing sign routes, not only to minimize confusing the travelling public, but to reduce the costs of re-signing.

The renumbering program was carried out in cooperation with mapmakers and met with favorable public reaction.

Highway Aesthetics

Approximately 5,000 miles of the state highway system were designated as state scenic highways by the 1963 Legislature, which also created an Advisory Committee on a Master Plan for Scenic Highways.

The seven-man committee was appointed by Governor Brown in January 1964 from among officials of cities and counties, persons having special competence in the field of landscape architecture as it relates to scenic conservation, and others interested in highways, land planning and parks.

Meeting monthly, the committee is studying standards for the preservation of values in the scenic corridors outside the highway right-of-way but within sight of the motorist. It is assisted in this study by the State Office of Planning and an interdepartmental staff committee composed of representatives of the Departments of Public Works, Water Resources, Parks and Recreation, and the State Office of Planning.

At the same legislative session, Senate Bill 173 was enacted which authorized an eventual total of 250 safety roadside rests along state highways, at approximate half-hour intervals of normal driving time, and at the approaches to metropolitan centers, for map inspection purposes, at an estimated cost of $5,845,000 for construction and $1,164,000 each year for maintenance.

The Division of Highways now has 24 such rest areas in operation, including 11 transferred to it from the Division of Beaches and Parks. Seven more are under construction, and work will start in 1965 on an additional 26.

During the past fiscal year, 30 landscaping and functional and tree planting projects were financed at a cost of more than $3,196,000. These projects involved the planting of approximately 118,700 trees and shrubs and 4,880,800 ground cover plants.

Contract Data

During the 1963–64 fiscal year, the Division of Highways opened bids on 551 projects with an estimated construction value of $414,127,800, including construction engineering. Of these, contracts were awarded for 516 projects with a value of $402,980,400 and 20 bids were rejected as not being in the best interest of the state. The 15 remaining contracts were awarded after the close of the fiscal year.

Contracts also were awarded during the year for nine projects, valued at $8,442,300, on which bids had been received during the previous fiscal year.

The cost of right-of-way acquisition and utility relocation, exclusive of land clearance, overhead, and acquisitions for other agencies, amounted to approximately $165,943,700.

The total of $411,422,700 in contracts awarded during the year, was made up of $367,810,400 for construction on state highways; $18,861,300 for work on county roads, including the federal aid secondary system; and $24,751,000 for maintenance and emergency repair, and work for other agencies.

The contracted state highway work involved improvement of 1,519 miles of highways and construction of 444 bridges and separation structures.

Construction Progress

This view looks easterly to the new 3,371-foot two-lane bore on Route 24 (upper left), paralleling the existing bores of the Caldecott Tunnel through the Berkeley Hills. When the eight-lane freeway (to right of existing highway) is completed next fall, the middle bore will be used on a reversible basis so as to provide four lanes in the direction of peak commuter traffic morning and evening. Construction in the embankment area at left and above the existing highway involves the relocating of a portion of Tunnel Road.

On November 1, 1964, while officials of California, Nevada and the federal government were preparing to dedicate the Donner Summit stretch of the Interstate 80 Freeway across the high sierra, the first snow of the season was falling.

A truck skidded on the existing two-lane highway. The resulting traffic tieup dramatized the need for the new, all-weather route, now open to traffic as freeway and expressway for its full 206 miles from San Francisco to the Nevada line, except for a section now under construction or budgeted through Sacramento.

The final 10.5-mile freeway segment replaced the slow and tortuous climb over Donnor Summit, a steep and dangerous section plagued by snow, congestion and accidents.

Meanwhile, about 370 miles to the south, the state's 1,500th mile of full freeway was completed in October on Interstate 15. It was contained in a 17-mile unit between Field and Cronese Valley, west of Baker, in the Mojave Desert.

Construction emphasis in 1964 again focused on these and other routes in California's 2,173-mile portion of the national system of defense and interstate highways.

In metropolitan areas, important freeway sections were started, continued or completed on Interstate 5 in and near San Diego, on Interstate 10 (Santa Monica Freeway), Interstate 405 (San Diego Freeway), and Interstate 605 in Los Angeles and Orange Counties, on the Route 82 Freeway in San Francisco, on Interstate 580 in Alameda County, on Interstate 80 in Sacramento, and on Interstate 5 and US 101 in northern California, to name a few.

In addition, various highways were widened, curves eased, and traffic signals and left-turn lanes were installed in the interest of traffic safety.

In other words, the construction program was balanced geographically as well as between remedying today's highway deficiencies and providing for tomorrow's traffic needs in all sections of the state.

San Diego and Imperial Counties

Interstate 5 in and north of the San Diego area continued to get a major share of attention in the southernmost end of the state, but construction activity was also stepped up on Interstate 8 to the east and carried forward on other routes.

The Interstate 5 Freeway between Palm Street and 28th Street in San Diego was extended southerly to 13th Street in National City in April, and work is underway to continue this eight-lane facility to the south city limit, linking with the Montgomery Freeway to the Mexican border.

A northerly extension of Interstate 5 from Palm to Washington Street in San Diego will be completed next summer, and work will start soon to continue it to Rosecrans Street.

The 1965–66 budget provides funds to construct a one-mile freeway section on I-5 north of the San Diego River to eliminate a highway section with a high fatality rate.

Construction began in the fall on two I-5 Freeway projects totaling seven miles through Rose Canyon to Camp Mathews, and betwen Miramar and Carmel Valley Roads. A connecting section will be advertised for bids this winter.

The new budget finances construction on I-5 for four miles northerly to Via de la Valle near Del Mar, and

Plants and ground cover installed in a landscaping project, completed in September 1963, begin to develop at the four-level interchange between the Interstate 5 and US 395 Freeways in San Diego.

construction is in progress for an additional 11 miles to the south city limit of Carlsbad. From there, a 1.5-mile newly budgeted section to Cannon Road in Carlsbad will connect with the existing four-lane freeway extending to the San Luis Rey River at Oceanside, and another 10-mile newly budgeted project north of the river will connect to a four-lane expressway to the Orange county line.

Widening of Interstate 8 from six to eight lanes was completed in the fall for five miles in and west of La Mesa, and a four-mile, four-lane freeway project extending the freeway from San Diego to Harritt Road east of El Cajon will be completed next April. Bids were opened in November for a three-mile project to continue it toward Alpine.

Farther east, the new budget provides funds for a 10-mile freeway section on I-8 between Boulevard and the Imperial county line, connecting to a 10-mile section in the Mountain Springs area, the completion of which has been delayed by a slide until spring, and for five miles in Imperial County between El Centro and Route 111.

A 3.5-mile four-lane freeway on US 395 north and south of Poway Road west of Poway in San Diego County will be completed next spring, and work is starting on a two-mile section connecting to the four-lane expressway into San Diego.

North of Poway Road, a five-mile freeway extension of US 395 to Rancho Bernardo Road has been budgeted. A two-mile four-lane expressway south of Escondido was nearing completion at year's end and another two-mile expressway section north of the city is in progress.

A four-lane Route 78 Freeway westerly from US 395 in Escondido was completed in December, providing freeway and expressway service on this route to Interstate 5 in Oceanside.

A 2.5-mile four-lane freeway project on Route 67 near Santee in San Diego County will be completed next summer, and a four-lane Route 111 Expressway between the north city limit of Calexico and the future Interstate 8 Freeway was started in the fall.

San Bernardino and Riverside Counties

On the three Interstate routes crossing the vast deserts of southeastern California, construction emphasis has moved from the nearly completed Interstate 15 (Barstow Freeway) to Interstate 40 (US 66) and Interstate 10 east of Indio.

The Interstate 15 Freeway between Yermo and Field, northeast of Barstow, was completed last spring, and a 16.8-mile northeasterly extension to Cronese Valley was completed in October. This latter section contained California's 1,500th freeway mile.

Construction is also in progress on this freeway route for 18 miles northeasterly to Baker. This final project will complete Interstate 15 as full freeway between the Nevada line and Barstow, and freeway and expressway southwesterly to San Bernardino.

Bids were opened in December to convert 6.7 miles of I-15 from expressway to freeway standards in and near Victorville.

On I-40, an 8.7-mile freeway project southeast of Barstow will be completed next spring, and construction has started on the approaches and four-lane freeway bridge across the Colorado River near Needles.

Funds for I-40 in the 1965–66 budget will provide for construction of almost 32 miles between east of Daggett and west of Ludlow, and for nearly 13 miles east and west of Needles, at an estimated cost of about $17,500,000. Work is scheduled to start next spring to connect the future freeway east of Needles with the Colorado River Bridge.

Widening of the San Bernardino Freeway (I-10) from four to eight lanes for six miles in and east of Ontario is starting, and the new budget's funds will continue this widening easterly to Pepper Avenue near Colton.

Another 11-mile project in progress on I-10 will convert this route from four-lane expressway to six-lane freeway between Redlands in San Bernardino County and Beaumont in Riverside County by next spring.

An eight-lane freeway on I-10 was completed in November for the five miles between Banning and the east city limit of Cabazon, and work will start soon on a five-mile easterly extension to Route 111 west of Whitewater.

East of Indio, a 10-mile stretch of four-lane I-10 Freeway was completed in April and work is in progress on another 14-mile easterly extension. The new budget will finance another 27 miles between east of Desert Center and 18 miles west of Blythe.

On noninterstate routes, construction of an interchange at Crestline in San Bernardino County between Routes 18 and 138 is scheduled for completion by the end of 1965. Funds in the new budget will permit construction of a four-lane freeway on Route 18 through Waterman Canyon in the San Bernardino Mountains.

A 5.4-mile freeway section on US 60 was opened to traffic in June between Sunnymead and Route 177, completing freeway and expressway construction on this route between Ontario in San Bernardino County and its terminus at I-10 at Beaumont in Riverside County.

The conversion of US 60–395 from four-lane expressway to six-lane freeway is just starting between the University of California in Riverside and the separation of the two routes east of the city.

Widening of Route 111 to four lanes between Cathedral City and Palm Desert was completed and widening to four-lane divided expressway between Palm Springs and I-10 was begun this fall.

Los Angeles Metropolitan Area

Just as the I-10 (Santa Monica) and the I-5 (Golden State) Freeways formed an inner loop around the Los Angeles downtown area in 1962, the I-405 (San Diego) and I-605 Freeways will form an outer loop west, south and east of the Los Angeles central district.

The I-405 (San Diego) Freeway, opened to traffic in 1963 from its junction with the I-5 (Golden State) Freeway north of San Fernando to southeast of the Route 7 (Long Beach) Freeway at a cost of more than $50,000,000, was extended southeasterly to the Orange county line early in 1964, and partly opened to Bolsa Chica Road in Seal Beach in October. The latter section will be completed in the spring and work has been advertised for bids to extend it to Fountain Valley.

The I-605 Freeway was completed from Whittier to Industry in June, and was extended northerly to the I-10 (San Bernardino) Freeway in Baldwin Park in October. It is also under construction southerly to the I-405 (San Diego) Freeway. The new budget will finance a portion of its extension as the Route 240 Freeway, a noninterstate facility, southerly to the Route 22 (Garden Grove) Freeway.

A 1.7-mile section of the Garden Grove Freeway was completed in July east and west of Route 39 (Beach Boulevard) in Orange County. This freeway route, which eventually will extend from the Route 55 (Newport) Freeway in Orange County to Route 1 (Pacific Coast Highway) in Los Angeles County, is under construction between the I-5 (Santa Ana) and the I-405 (San Diego) Freeways.

A 1.9-mile four-lane section on the Route 55 (Newport) Freeway south of the Santa Ana Freeway was completed in December.

The I-10 (Santa Monica) Freeway was completed for 5.5 miles west to La Cienega Boulevard in November, and work is underway to connect it with the Pacific Coast Highway (Route 1) in Santa Monica by late 1965.

The 1965–66 budget will finance projects to connect and extend two jobs under construction on the Route 60 (Pomona) Freeway between the East Los Angeles Interchange and south of Industry.

The Route 14 (Antelope Valley) Freeway will be extended northeastward for eight miles to the Angeles Forest Highway by next summer, and the 1964–65 and 1965–66 budgets will finance additional construction northerly to Palmdale, plus the grading and structures on a section between southwest of Lancaster and the Kern county line.

The new budget will finance completion of the interchange between the I-5 (Golden State) Freeway and the Route 134 Freeway in Los Angeles; the construction of the eight-lane Route 134 Freeway from this interchange to Glendale, and the addition of auxiliary lanes on I-5 north of the interchange area.

Budgeted funds will also provide for extending the Route 170 (Hollywood) Freeway 1.7 miles northerly to Victory Boulevard in North Hollywood.

Widening of the Interstate 5 (Santa Ana) Freeway in and near Santa Ana

The interchange between the Garden Grove (Route 22) Freeway (upper) and the Interstate 5 (Santa Ana) Freeway in the Orange–Santa Ana area was completed in September. The former freeway is now under construction between the Santa Ana and the Interstate 405 (San Diego) Freeways.

PHOTO LEFT: A bulldozer finds rough going in the difficult terrain of Lee Vining Canyon east of Yosemite National Park in Mono County. Two miles of the Tioga Pass Road (Route 120) are under construction as a two-lane expressway, and another 4.1 miles have been budgeted.

was completed in February, and the new budget provides funds to widen 3.5 miles of the Ventura Freeway (US 101) west of Los Angeles, and 1.4 miles of the Route 7 (Long Beach) Freeway between Vernon and Los Angeles.

On the Ridge Route section of Interstate 5 (US 99) in northern Los Angeles County and extending into Kern County, freeway sections were completed in the fall of 1964 at the Castaic Junction end (3.7 miles) and at the Lebec end north of the summit (4.7 miles). The latter project serves as a southward extension of the Grapevine Grade Freeway completed in 1960.

Conversion of the entire Ridge Route to interstate freeway standards also moved closer to completion with the inclusion in the 1965–66 budget of projects costing a total of nearly $50,000,000 to construct 13 more miles of freeway and do the heavy grading for an additional 12.4 miles in mountainous terrain.

San Joaquin Valley and Central Mountain Counties

As the conversion of US 99 to full freeway status throughout the length of the San Joaquin Valley moved closer toward realization in 1964, large-scale work was just getting underway on the vast project which will occupy the construction spotlight for the next few years—the Westside Freeway (Interstate 5). Progress was also made on some of the lateral routes in the valley and neighboring mountain areas.

Conversion of US 99 from four-lane expressway to six-lane freeway from the completed Bakersfield Bypass Freeway north to Cawelo in Kern County was scheduled to be completed by the end of 1964.

An eight-mile freeway section on US 99 between south of the Tulare-Fresno county line and Selma was completed in October, providing full freeway between McFarland in Kern County and the San Joaquin River northwest of Fresno.

A four-mile freeway extension of this route to south of Madera was completed in May, and a newly budgeted project will complete expressway-to-freeway conversion to Madera, linking with the freeway through that city.

Farther north, a US 99 Freeway through Ceres and Modesto in Stanislaus County will be completed by next spring, and a 7.1-mile expressway-to-freeway conversion north of Stockton in San Joaquin County was opened to traffic in December.

A newly budgeted project will convert US 99 to six-lane freeway north from the Stanislaus-San Joaquin county line to Ripon, and the Lodi Bypass Freeway on this route was completed in February.

On the Interstate 5 (Westside) Freeway, the 1965–66 budget provides funds for construction of 36.4 miles, extending construction now in progress (between west of Los Banos and southwest of Gustine in Merced County) northerly through Stanislaus and southern San Joaquin Counties to a junction with the Interstate 580 Freeway near Tracy.

Another newly budgeted project on the Interstate 580 Freeway will connect with projects now under construction or previously budgeted to one mile west of the Alameda-San Joaquin county line.

The 1965–66 budget also provides for preliminary work on the Interstate 5 (Westside) Freeway in Kern and Fresno Counties.

In Kern County, a 5.2-mile freeway stretch on Route 178 in and east of Bakersfield is scheduled for completion by mid-1966. The grading of 7.6 miles of the Route 58 Freeway between Keene and Tehachapi was completed in October, and a contract for paving this section has been awarded.

An 8.5-mile freeway and expressway project on Route 198, extending the completed section east of the Lemoore Naval Air Station to Hanford in Kings County, will be finished next spring. The 1965–66 budget provides funds to extend it through and east of Hanford.

Farther east, a four-lane freeway on this route through Visalia in Tulare County will be completed in the spring; the grading of a 9.4-mile east-

erly extension is in progress, and its completion has been budgeted.

A 7.3-mile two-lane expressway on Route 41 was completed in November north of the North Fork Kings River in Kings and Fresno Counties, and a project for the construction of a six-lane freeway viaduct on this route in the City of Fresno will start this winter.

In Merced County, a 12.4-mile four-lane expressway on Route 152 around the area to be inundated by the San Luis Reservoir in the Pacheco Pass area will be opened to traffic in February.

A two-lane expressway was completed in July on Route 49 in Mariposa County between south of Coulterville and the Tuolumne county line, and a realignment project on Route 132 west of Coulterville was completed in September.

A two-lane expressway on Route 108 in Tuolumne County east and west of Long Barn will be completed by summer; a 5.6-mile two-lane expressway on Route 4 in Calaveras County west of the Alpine county line is scheduled for completion in July; 5.7 miles of two-lane expressway on Route 88 near Silver Lake in Amador County were completed in September, and an 8.7-mile easterly extension to the Alpine county line will be completed next summer.

East of the Sierra Nevada, two miles of two-lane expressway are under construction on the Tioga Pass Road (Route 120) in Mono County west of Lee Vining, and another 4.1 miles have been budgeted.

Sacramento Valley and Northern Counties

Long stretches of the two interstate routes in northern California—Interstate 5, a north-south arterial between the Oregon and Mexican borders, and Interstate 80, between San Francisco and the Nevada line—were completed, under construction or budgeted in 1964.

On Interstate 5, a total of 81.5 miles are involved in projects which are completed, under construction or budgeted between south of Willows in Glenn County and north of Redding in Shasta County.

This section of the Interstate 5 Freeway is part of a 12.2-mile project completed in April between Red Bluff and the Shasta county line. A total of 81.5 freeway miles on this route are completed, under construction or budgeted between south of Willows in Glenn County and north of Redding in Shasta County.

Farther north, the Pit River bridge across an arm of Shasta Lake on Interstate 5 will be widened by next summer, and a short section of this route in and north of Dunsmuir is being converted from expressway to freeway standards.

The new budget provides funds for the construction of 4.6 miles of Interstate 5 Freeway between north of O'Brien and the south end of the Sacramento River Bridge at Antler.

A 6.8-mile section of this route north and south of the City of Mount Shasta in Siskiyou County was completed in November, and a 1.5-mile section south of the Oregon border will be constructed with funds in the new budget.

On Interstate 80, freeway projects in Solano County include conversion of 7.1 miles southwest of Vacaville from four-lane expressway to six-lane freeway, to be completed by the end of 1965; a 5.1-mile freeway between Vacaville and northeast of Route 505, completed in October; and a 3.7-mile six-lane freeway northeast of Route 505, to be completed next fall.

Also on Interstate 80, the substructure of a new bridge across the Sacramento River was completed last summer, and construction of the superstructure and two miles of freeway approaches in Yolo County and the City of Sacramento was started in August.

The new budget authorizes projects which will provide 2.3 freeway miles east of the bridge approach in Sacra-

This view looks southeasterly at the 29th–30th Street Freeway (Interstate 80) construction now in progress in Sacramento. The graceful tapered columns will support the viaduct structures.

mento between W and X Streets, connecting with two projects underway on this route between 29th and 30th Streets and completing construction on I-80 through the city.

In the mountains a 12-mile project on Interstate 80 between Emigrant Gap and Hampshire Rocks was completed this fall, and the 10.5-mile freeway stretch superseding the slow and difficult climb over Donner Summit was opened to traffic on November 20.

Other newly budgeted projects in Sacramento County include the widening of 2.8 miles of the existing I-80 Freeway and the American River Bridge from four to six lanes, and the widening of 1.1 miles of the Route 160 Freeway from four to six and seven lanes. The latter project involves constructing an additional structure paralleling the 16th Street Bridge.

On US 50, freeway construction is underway between east of Folsom Junction in Sacramento County and east of the El Dorado county line. A two-mile expressway section west of Camino was completed in August, and a 5.5-mile freeway section near Pollock Pines is nearing completion.

In Butte County, the Route 99 Freeway in Chico will be extended southerly to south of the Skyway Turnoff by the end of 1964, and a project to complete this freeway route through the city has just started.

A 1.9-mile Route 44 Freeway easterly from Market Street in Redding in Shasta County is under construction and an 8.5-mile section east and west of Palo Cedro was completed in October.

Bids were opened in December on the first unit of the four-lane Grass Valley-Nevada City Freeway on Route 20, a 3.3-mile section in Nevada County.

In Sutter County, 3.6 miles of four-lane expressway on Route 20 west of Yuba City were completed in June.

A 3.3-mile two-lane expressway on Route 299 northeast of Adin in Modoc County was completed in mid-year, as was a 4.8-mile two-lane expressway on Route 36 in Lassen County between Susanville and east of Johnstonville. The new budget provides funds for two-lane expressway projects on Route 36 in Lassen County near Susanville and on US 395 in Modoc County north of the Lassen county line.

In Yuba County, the 12th Street Underpass on Route 20 in Marysville was completed in December.

Central Coast Counties

There was steady progress in 1964 in the continuing program of converting US 101 to full freeway standards, and in constructing freeway and expressway sections on Route 1, the scenic route along the coast.

In Ventura County, a 4.5-mile expressway to freeway conversion project on US 101 near El Rio will be completed as 1964 ends. Funds have been budgeted for the conversion of a 3.6-mile section between El Rio and Montalvo from four-lane expressway to six-lane freeway, and for the construction of interchanges in Newbury Park and Camarillo.

Santa Barbara County projects on this route include a 2.3-mile freeway section in the City of Santa Barbara, completed in January, and a freeway bypass of Buellton, now under construction.

Farther north, a two-mile expressway to freeway conversion of US 101 south of San Luis Obispo was completed in July. The new budget provides funds for additional conversion between Atascadero and Paso Robles.

A 4.8-mile US 101 freeway section between north of San Miguel in San Luis Obispo County and north of Camp Roberts in Monterey County has just been completed, and a 6.7-mile northerly extension to north of Bradley will be opened to traffic next fall. This will connect to an 11.3-mile freeway section to south of San Ardo which was completed in August.

A 4.1-mile freeway section in and north of Salinas is scheduled for completion next summer.

On scenic Route 1, a project is nanced in the 1965–66 budget to construct a two-lane expressway for the 8.8 miles between US 101 at Las Cruces and San Julian Ranch in Santa Barbara County.

In San Luis Obispo County, a 4.4-mile two-lane expressway bypass of Cambria on this route was completed in the spring, and a 2.8-mile four-lane freeway in and north of Cayucos will be completed next fall. Funds in the new budget will finance adding two lanes on Route 1 for 4.4 miles north of Camp San Luis Obispo, completing four-lane expressway between San Luis Obispo and Morro Bay.

Budgeted projects on Route 1 in Monterey County include a four-lane freeway section in and near Castroville and completion of the Watsonville Bypass Freeway.

Construction of the US 101 Freeway in the City of Santa Barbara, completed last January, was complicated by the proximity of a railroad (at left), Mission Creek (at right of the freeway fence) and Wilson School.

Shown is part of a recently completed 5.1-mile freeway section on Interstate 80 between Vacaville and northeast of Route 505 in Solano County. Another 7.1 miles of this route southwest of Vacaville will be converted from four-lane expressway to six-lane freeway by the end of 1965, and a 3.7-mile six-lane freeway northeast of Route 505 will be opened to traffic next fall.

On other routes, Ventura County projects include budgeted jobs to construct 3.9 miles of the Route 118 Freeway through Santa Susana Pass, and the extension of the Route 33 Freeway 2.9 miles northerly to Casitas Pass Road south of Ojai.

An 8.6-mile project on the Route 126 Freeway to extend it easterly to Santa Paula is scheduled for completion in the summer.

Seven miles of two-lane expressway on Route 154 north of San Marcos Pass in Santa Barbara County were opened to traffic in February, which, together with a bridge across Cold Springs Canyon completed late in 1963, eliminated tortuous curves and steep grades on the older highway.

The new budget provides funds for the construction of a two-lane expressway on Route 180 in San Benito County between south of Hollister and north of Tres Pinos, a distance of 3.1 miles.

The Route 82 Freeway in San Francisco extends northeasterly across the US 101 (James Lick Memorial) Freeway as a two-level structure to the vicinity of a future interchange with the adopted freeway routing via Hunters Point. The new budget provides funds to extend it northerly as the Route 87 Freeway to north of 18th Street.

San Francisco Bay Region

Four projects were completed or in progress in Alameda County in 1964 to extend the eight-lane Interstate 580 Freeway, which was opened to traffic in 1962 from the San Francisco-Oakland Bay Bridge distribution structure to Park Boulevard in Oakland, another 11 miles to south of San Leandro.

A new 3,371-foot two-lane bore on Route 24, paralleling the existing bores of the Caldecott Tunnel through the Berkeley Hills, plus a two-mile eight-lane freeway between the tunnel's east end and Orinda, were opened to traffic in October. The new tunnel will permit the renovation in stages of the older two-lane bores.

A 1.3-mile eight-lane freeway from the tunnel to the Temescal interchange in Oakland will be completed next fall, permitting use of all six lanes of the tunnel, with the middle bore on a reversible basis so as to provide four lanes in the direction of peak commuter traffic morning and evening.

On the Interstate 680 Freeway in Alameda and Contra Costa Counties, a newly budgeted project for 8.7 miles north of Route 84 near Scotts Corner will connect to construction now in progress to one mile north of the Contra Costa county line. A northerly extension to Danville will begin in early 1965, connecting to newly completed freeway construction which in turn extends to Walnut Creek.

The above listed I-680 projects, together with previously completed sections, will provide full freeway between Fremont in Alameda County and Vallejo in Solano County on this bay area circumferential route.

On Route 21, about 12 miles of four-lane freeway are under construction between I-680 at Benicia and 0.5-mile south of I-80 at Cordelia. This project is financed by toll bridge revenue bonds to improve the approaches to the bridge between Benicia, Solano County, and Martinez in Contra Costa County.

A 1.3-mile Route 13 (Warren Boulevard) freeway section now under construction between Atlas Avenue and the I-580 Freeway will complete this route through Oakland.

Bids were opened in late November to convert three miles of Route 92 from a two-lane highway to a four-lane freeway between the San Mateo-Hayward Bridge and Hesperian Boulevard in Hayward.

The new budget finances the widening of the Route 17 (Nimitz) Freeway from four to six lanes between Route 92 in Hayward and Washington Avenue in San Leandro.

In San Francisco, the Route 82 Freeway was completed as a viaduct between the James Lick Memorial (US 101) Freeway and Newcomb Street in the spring, and construction progresses northeasterly, with ramps, to Army Street. The new budget finances construction from the site of the future interchange with the adopted freeway via Hunters Point, northerly as the Route 87 Freeway to north of 18th Street.

Southwest of the James Lick Memorial Freeway, construction completed last year to Mission Street was extended 2.9 miles to Orizaba Avenue.

A project now underway will connect the Route 82 Freeway at Orizaba Avenue with the I-280 Freeway in Daly City, San Mateo County, by mid-1966, and a southerly extension of I-280 to South San Francisco will start next summer.

The 1965–66 budget provides funds for constructing this freeway between south of Route 186 in San Bruno and Millbrae, and for rough grading southerly to Hillsborough. It also will complete the financing of an eight-lane freeway bridge across San Mateo Creek in and near Hillsborough.

Other San Mateo County projects will provide a completed Route 1 Freeway section in Pacifica by next spring, and a Route 114 Expressway connection between El Camino Real (Route 82) and US 101 in Redwood City by next summer.

In Santa Clara County, about two miles of six-lane I-280 Freeway were opened to traffic in March west of San Jose; a 3.5-mile northwesterly extension to Cupertino has just been completed; and a 0.7-mile section to Sunnyvale, including a connection to the Route 85 Freeway will be completed next spring.

Budgeted funds will finance the completion of the I-280 Freeway between the I-680 Freeway in San Jose and Los Altos Hills.

A 5.5-mile section of the Route 85 Freeway will be completed next fall between Cupertino and US 101 in Mountain View.

In Marin County, the freeway interchange between US 101 and Route 37 near Ignacio was completed in the summer, and a 3.1-mile US 101 freeway section between Novato and north of San Rafael will be completed this winter.

Conversion of one mile of Route 29 from two-lane expressway to four-lane freeway in and near Napa in Napa County was completed in April, and the 1965–66 budget provides funds for the conversion of an additional 1.3 miles.

Sonoma County projects include a 5.3-mile US 101 freeway section near Cloverdale, completed in December; a 1.1-mile section in and near Santa Rosa, to be completed next spring; and a 4.3-mile Route 12 freeway section in and west of Santa Rosa, completed in October.

Northern Coastal Counties

In Mendocino County, two four-lane US 101 freeway sections totalling 10.6 miles north and south of Ukiah were completed this year, and a connecting section completing the bypass of the city will be opened to traffic next fall.

Farther north, a 2.6-mile freeway section on this route in Humboldt County will be completed next summer between Dean Creek and Sylvandale, connecting to a 5.9-mile section completed in October to south of Miranda.

A project will be advertised for bids this winter for 7.7 miles north of Englewood, completing 33 miles of four-lane Redwood Parks freeway between Dean Creek and south of Scotia.

North of Arcata, an eight-mile freeway on US 101 around McKinleyville was completed in late October, filling the gap between the Arcata and Trinidad freeway sections.

Since this section provides a magnificent view of the Pacific Ocean from US 101, the first such opportunity on this route north of San Francisco, a vista point and a 1.5-mile frontage road along the beach were constructed as part of the project to give ready access to this recreational area.

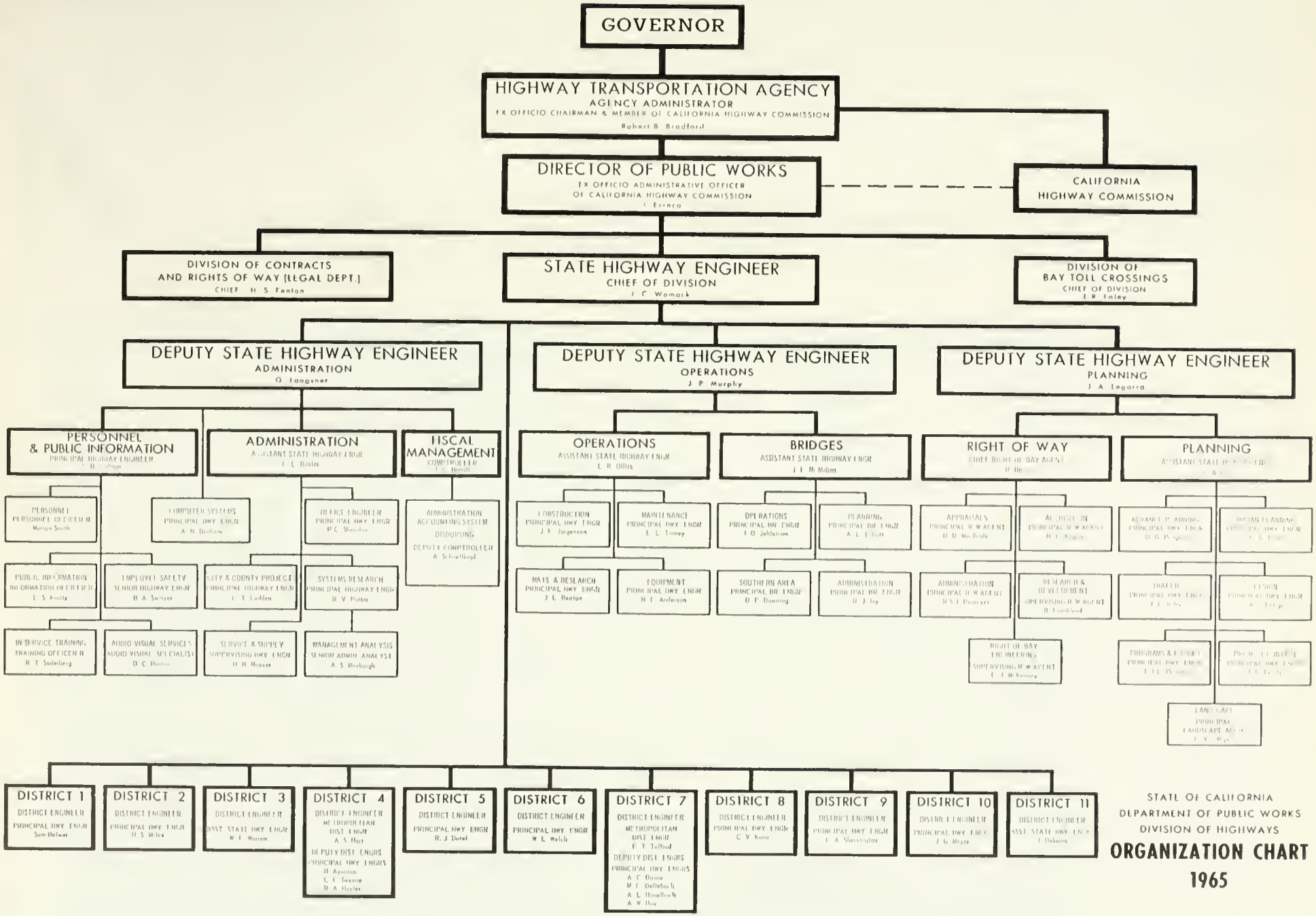
A five-mile four-lane freeway grading project will be completed this winter on US 101 from a mile south of the Humboldt–Del Norte county line to Klamath, and work is progressing on construction of bridges across the Klamath River and its overflow channel. A contract for paving the graded section will be underway next spring.

A 3.2-mile two-lane expressway on Route 1, the Shoreline Highway, near Mendocino was completed in August and another 4.5 miles north of Russian Gulch was started in the fall. A third Route 1 project opened 3.3 miles of two-lane expressway between Ferndale and Fernbridge in September.

A four-lane freeway on Route 299 for 4.5-miles between the Mad River east of US 101 and Blue Lake in Humboldt County will be completed next fall.

The 1965–66 budget will finance a 6.2-mile two-lane expressway on Route 29 in Lake County between south of Kelseyville and Route 175.

PHOTO RIGHT: A 10.5-mile section of Interstate 80 (divided freeway in distance) was opened to traffic on November 20, superseding the steep and twisting climb over Donner Summit (foreground).



STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

ORGANIZATION CHART
1965

Operations

The Construction, Maintenance, Equipment, and Materials and Research Departments are administered under the direction of the Assistant State Highway Engineer—Operations

CONSTRUCTION

Administration of construction contracts, except for those consisting primarily of structures and administered by the Bridge Department, is the responsibility of the district in which the project is located.

This assignment is carried out through the teamwork of a staff of engineers, technicians and others whose primary duties are to assure that the terms of the contract are met. This involves interpretation and enforcement of specifications and plans. Headquarters Construction Department acts as a staff department for the State Highway Engineer for purposes of coordination and uniformity of contract administration.

The work itself is performed by the contractor's organization and forces. It is the contractor's job to plan his work, determine what methods and equipment he will use, procure and produce the necessary materials, and to accomplish the planned project according to the lines and grades set by the engineer, in compliance with the specifications governing the work.

The workmen at right prepare to set demolition charges during the construction of a 12.4-mile, four-lane expressway on Route 152 to bypass an area which will be used for the San Luis Reservoir.

Special Projects

There is a continuing appraisal of methods of handling traffic through construction areas. The results of this study will be incorporated in expanded instructions for the guidance of field forces.

The frequent occurrence of high overfills over pipe culverts has emphasized the necessity for anticipating all combinations of loading and installation conditions. A reappraisal of conventional installation practice has been undertaken in conjunction with the Bridge, Design, and Materials and Research Departments.

The divisionwide program of training in inspection procedures for portland cement concrete construction, commenced in the spring of 1963, was completed in April 1964. This program was presented by the Headquarters paving engineer with the cooperation of the division training officer and the Portland Cement Association. Approximately 1,700 highway personnel attended this comprehensive 12-hour program of lectures which were supplemented by more than 400 colored slides and an hourlong 16-mm. film.

Now in preparation is a program of training in inspection procedures for asphalt concrete paving. It is expected that this program will be ready for divisionwide presentation during the winter months 1964–65.

Construction Practice

Slipform paving methods were used for more than 80 percent of the portland cement concrete pavement placed during the past year. Several of these projects achieved outstanding production records wherein average output was in excess of 400 cubic yards per hour, practically doubling the usual figure; and monolithic 36-foot-wide paving has become common practice for several contractors on those projects requiring 36-foot-wide pavements.

The use of central mixed concrete for paving has rapidly expanded until it is now uncommon to see onsite paving mixers in operation. This is largely due to the fact that a 50-second mixing time has generally been found to be adequate for the large capacity mixers now available and to the econ-

onies inherent in a central plant set-up. Common end dump trucks, with but very slight modification to effect a self-cleaning dumping action, have proved very successful, also, for hauling air-entrained paving concrete, and have become the accepted means of transporting central mix.

Many contractors have successfully coupled the use of slipform paving methods with the use of central plant mixing, while others have coupled the use of the newly developed tilt-drum truck paving mixers with slipform paving methods.

The trend in asphalt concrete pavement construction is similarly directed toward more efficient batching and mixing plants and high production lay-down equipment. The 24-foot-wide asphalt paving machines made their initial appearance during the year. Fully automated plants are making more frequent appearances; however, while they are now available from several manufacturers, automatic paver controls have not been extensively utilized.

Honor Camp Projects

The Division of Highways and the Department of Corrections continued the joint operation of Camp No. 41 near Happy Camp on the Klamath River in Siskiyou County, and Camp No. 42 near Lord Ellis Summit in Humboldt County on Route 299.

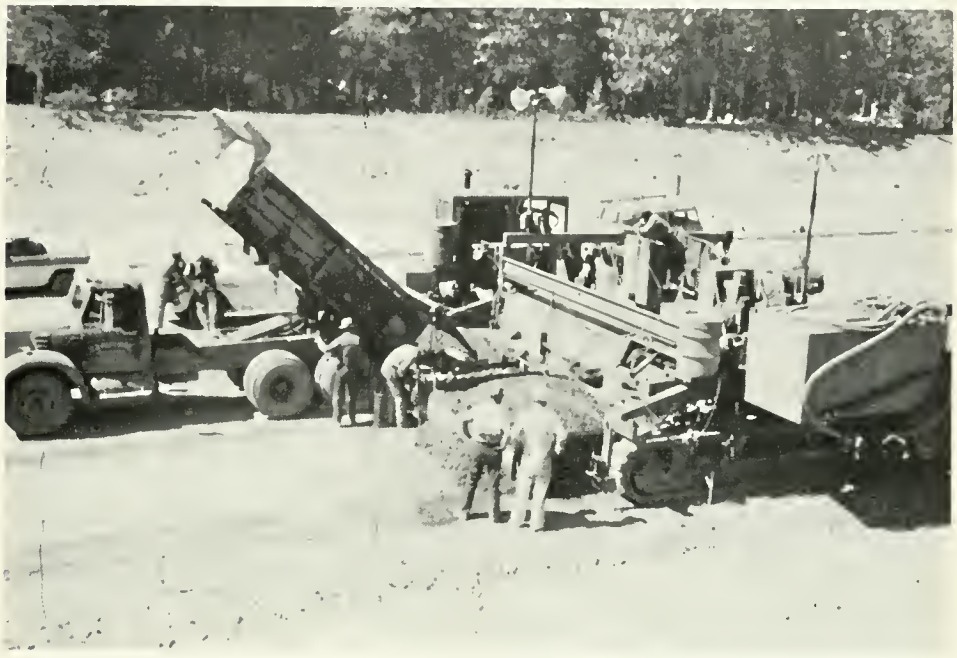
Camp 41 crews extended construction work down the Klamath River toward Ti Bar Ranger Station, with clearing well along in the section between the present Klamath River Bridge near Dillon Creek and Ti Bar.

A 2½-mile section of road extending downstream to Swillup Creek was oiled and screenings placed. Grading and placement of selected material has been extended 3½ miles downstream from Swillup Creek and currently grading is being completed in the Vicinity of Dillon Creek downstream to the proposed new crossing of the Klamath River.

A rest area and rubble masonry drinking fountain has been built at a scenic location along the new roadway.

Work performed by Camp 42 on Route 299 consisted primarily of grading and related drainage installations from Redwood Creek to 2½ miles east, and clearing from Preston Ranch Camp westerly toward Blue Lake.

It is anticipated that the grading in this area will be completed by the end of 1965. A subsequent base and surfacing contract will provide a usable unit of roadway from Lord Ellis Summit to 2½ miles east of Redwood Creek.



Placing 24-foot-wide portland cement concrete highway pavements with an automatically controlled slip form paver. At top, end-dump truck delivers concrete mixed in a stationary tilt-drum central mix plant away from the construction scene. At bottom, tilt-drum truck paving mixers deliver concrete mixed in transit to the job site.

MAINTENANCE

During the 1963–64 fiscal year, approximately 3,850 maintenance men were employed to work out of 280 maintenance stations. A total of $47,816,800 was expended in the maintenance of 14,740 miles of highways, including state highways in cities.

New Routes Maintained

A total of 34.6 miles of former county roads was taken over for maintenance during this last fiscal year. These routes were added to the state highway system by the 1959 Legislature. The location, mileage, and route designation of these roads follow:

Butte County – Route 191, from Route 70 near Wicks Corner to Paradise—11.5 miles.

Riverside County—Route 79, from Route 127 north of San Jacinto to Route 10 near Beaumont—6.4 miles.

Calaveras County—Route 26, from Route 49 near Mokelumne Hill to West Point—16.7 miles.

Pavement Repair, Bridge Maintenance

The annual "thin blanket" program for which the Highway Commission sets aside $5,000,000 of construction funds is an important factor in providing the best possible road service to state highway users. Each year the Maintenance Department reviews and selects those sections of state highway where a one-inch asphaltic blanket will best serve to prolong the surface life and provide better riding qualities. Some 614 miles of resurfacing was accomplished under this program in the fiscal year.

"Giraffe" is used to relamp an electralier on freeway.

Although exact segregation of costs is not possible, at least half the cost is believed attributable to thoughtlessly and even deliberately discarded trash.

Roadside Vegetation, Tree Care and Landscaping

In past years roadside vegetation control work included fire hazard control, soil sterilization, mowing, discing, blading and noxious weed control. An expanded chemical program has been developed, combining many phases of this work, to eliminate duplication and effect economy. As expected, the use of chemicals continues to show a decrease in cost of vegetation control as compared to mechanical methods. The cost of noxious weed control on state highways, by counties is decreasing by virtue of expanded vegetation control by state forces. New chemicals are being tested on a continuing basis, and new spray rigs are being constructed for their application.

Rotary mowers, used for mechanically controlling roadside vegetation, are being replaced by flail-type mowers due to the hazards from thrown objects.

The landscaped area maintained per man is steadily increasing as a result of improved techniques, a better knowledge and application of chemical vegetation control, and improved irrigation systems. In view of the scarcity of water, a campaign has been launched to reduce the amount of irrigation on planted areas to a minimum. Heavy watering and fertilizing for the first two years is sufficient in most cases to attain the purpose for which a planting was made. Plants are then gradually weaned and furnished only enough water to maintain a healthy plant. After plantings of native or drought-resistant plants have become established, irrigation water is eliminated or greatly reduced. However, in such plantings, traffic smudge and dust must be washed from the foliage by a tank truck equipped with a high pressure pump and a fishtail spray. To the bath water is added a material which reduces surface tension, improving the leaf cleaning operation.

Lighting, Signals, Electrical Devices

All of the facilities maintained by the state highway signal and electrical crews continued to increase during the 1963–64 fiscal year. Traffic signals are increasing slowly, but highway lighting, illuminated signs, and electrical devices are increasing at a very rapid rate.

There was a 0.5-percent increase in traffic signals maintained, despite those relinquished to cities and counties, for a new total of 1,705 signals. The number of fluorescent tubes and incandescent lamps used in illuminated signs increased 10 percent to a new total of 21,473 lamps. In highway lighting, mercury vapor and sodium vapor lamps and fluorescent tubes increased by 12.8 percent for a new total of 31,248 lamps and tubes.

This is exclusive of tunnel lights. There are 10,507 tubes and incandescent lamps maintained in tunnels. Overall, the state maintains 63,228 lighting tubes and lamps on state highways.

Pavement Markings

The placement of traffic lines and pavement markings was accomplished during the year by the use of larger and more efficient striping machines and increased manpower. Depreciated small motor-driven striping machines are being replaced by larger, more efficient units capable of fulfilling the increasing needs for traffic stripe and pavement markings.

Thermoplastic striping operations have been extended in the metropolitan districts, eliminating the necessity for striping of crosswalks and gore stripes; the thermoplastic material should serve a minimum of five years. Several types of lane delineators are being tested in various locations throughout the state, with a view to increased traffic service and less frequent restriping.

During the year four machines placed 500 tons of thermoplastic marking material on highways, at the rate of one pound per square foot. Experience indicates that usually sandblasting or mechanical cleaning of the pavement must be done before application of this material.

Remote areas subjected to high wear, such as stop bars and pavement markings, are being renewed with permanent marking material preformed with a cold adhesive base.

Considerable use has been made of raised pavement markings of the "Botts Dots" type. These have varied from 4-inch round to wedges with and without plain white tops. Particularly promising are the reflex reflectors. These are placed at 24-foot centers, producing a clearly visible line both in clear and inclement weather. During the six months of operation, no loss of visibility due to damage to the reflectors has been observed.

In the 1963–64 fiscal year $2,808,400 was expended in replacing traffic stripes and pavement markings and repairing and replacing signs.

Communications

The statewide radio system at the end of the fiscal year consisted of 1,514 mobile radio units, 204 radio stations, 52 microwave stations, and 125 hand-carry units.

Improvements were made in the radio system to provide more reliable mobile radio coverage. One such project was the completion of the first phase of the microwave circuit on US 50 between Sacramento and Echo Summit. While the major use of radio is in maintenance work, the use of radio on construction projects was greatly expanded. In addition, radio is used in bridge maintenance and in various other operations functions.

The division continued operation of its leased, private-line teletypewriter system. The system is fully automatic with pushbutton or tape selection, with automatic message intercept and trouble indicators. The system operates at 75 words per minute, and approximately 2,700 messages per month are transmitted.

The division again provided a winter service of up-to-date road information to news media, radio and television stations, newspapers, automobile clubs, trucking concerns, other governmental agencies and the traveling public.

Outdoor Advertising

The administration of the Outdoor Advertising Act is financed solely through revenues derived from license and permit fees. A 1959 amendment to the Outdoor Advertising Act increased structure and sign permit fees.

Recent trends, creating a fiscal imbalance, made it necessary again to seek an increase in fee schedules. New legislation known as the Collier-Z'berg Act was enacted during the 1964 First Extraordinary Session of the Legislature. In addition to effecting tighter controls along interstate and defense highways when it becomes operative May 15, 1965, it provides for higher fee schedules.

Following are tabulations of comparative date for the last three calendar and fiscal years:

Number of advertising operators licensed for each fiscal year:

1961–62	880
1962–63	884
1963–64	818

Number of permits issued during the calendar year:

	Signs on sign structures	*Other signs*
1961	34,357	972
1962	33,258	1,826
1963	31,891	1,086

Gross receipts—licenses and permit fees and penalties for each fiscal year:

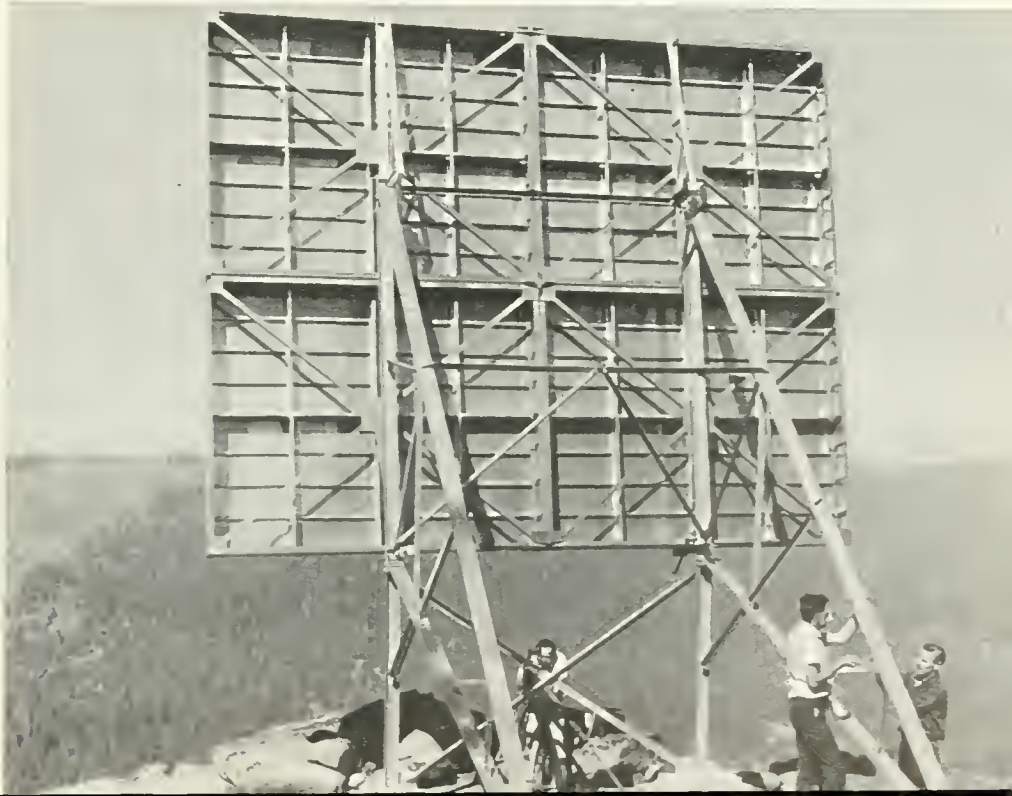
1961–62	$124,693.32
1962–63	118,047.78
1963–64	114,390.64

Permits

As anticipated, there was a significant reduction in the number of transportation permits issued for extralegal hauling operations. During the past fiscal year, some 15 percent fewer permits were issued as a direct result of 1963 legislation restoring the annual permit procedure for overwidth trailer coaches. Military certifications processed during the fiscal year increased slightly in averaging about 43 cases per month.

Encroachment permits cover installations or activities within state highway rights-of-way by other than the state or its contractors. As shown by the following tabulation there has

Installing a passive microwave reflector on Alder Ridge west of the Kyburz Maintenance Station on US 50. The reflector is part of the new US 50 microwave system communications which will link Sacramento and the Marysville district office with mobile units on this route. All equipment at this site was airlifted by helicopter.



been little change in the number of permits issued:

	1961–62	1962–63	1963–64
Encroachment permits	12,778	12,453	12,507
Transportation permits	75,603	101,542	86,181
Totals	88,381	113,995	98,688

Truck Scales

Plans have been developed by the Office of Architecture and Construction of the Department of General Services for three new truck scale installations located as follows:

Greenville, on US 50 in Altamont Pass.

Industrial Road, near the junction of Routes 92 and 17 in the vicinity of Hayward.

Tehachapi on Route 58 approximately one mile east of the junction with Route 223.

Three new truck scale installations are under construction. They are located as follows:

Little River, north of Arcata on US 101.

Northbound Castaic scale expanded to include brake inspection facility south of Castaic Junction.

Banning scales (replacing the existing ones at Whitewater) expanded to include a brake inspection facility for westbound movement only.

New loadometer pits have been made at several locations through the state where problems in connection with overloads justify their installation.

Maintenance Stations

Contracts were awarded for major construction at seven maintenance stations during the fiscal year. These include projects for the construction of new stations located at Elk Grove, South Sacramento, Whittier, McGee Creek, Calistoga and Redwood City and the enlargement of the station at Newhall. The total cost of these combined projects amounted to approximately $1,380,000. All seven contracts were handled by the Office of Architecture and Construction.

Land acquisition and/or preliminary engineering for major projects were undertaken on a number of stations, the most noticeable of which are Eureka, Santa Maria, Bakersfield, Chula Vista, Colusa and Lodi. It is expected that these installations will be under contract during the 1964–65 fiscal year.

Road Closures

There were numerous road closures, but of short duration, during the fiscal year. One six-day closure, on Route 116 in the Guerneville area of Sonoma County, was due to a forest fire. Most of the other closures were the result of flooding, debris and washouts.

The longer closures occurred on the Emerald Bay section of Route 89, which was blocked for 96 days; the Crescent City section of US 101, a five-day closure resulting from a seismic ocean wave, aftermath of the Alaska earthquake in late March; and on Route 1 near Thornton Beach in San Mateo County, November 24–December 13, 1963.

Numerous small slides closed other highways for one-day periods or less. There were seven such closures due to rock slides on Route 96, six miles southwest of Orleans, between September and May.

From February 1 to September 27, all IS 80 traffic in the vicinity of Whitmore Maintenance Station was carried on the westbound roadway due to two separate slipouts on the eastbound roadway.

Snow Removal

Snow removal and pavement sanding cost $3,467,200 in this rather mild winter. This was 7.2 percent of the total maintenance expenditures.

The snowpack on Donner Summit at the end of March amounted to 31 inches, compared to 53 inches the previous year and 85 inches for March 1962. The maximum snowpack at Donner Summit was 106 inches, recorded in January. There was only two inches of snow remaining on May 1. Unusually heavy snow closed the pass from Colfax to Donner Lake Gate for 16 hours on January 21 and 22.

As mentioned in the Equipment Department report, a used rotary snowplow was repowered with a new diesel powerplant and the fan was redesigned to increase the capacity of the unit by about 100 percent. In addition to its increased capacity, the rebuilt unit is able to cope with "tramp iron" pieces of tire chain, etc.) in the roadway without breaking down. The ability of this unit to stay in service under difficult operating conditions will mean more snow removal capacity with fewer units.

The regular winter closure of mountain routes where snow is not regularly removed occurred during the first week of November for the highways in the northern half of the state, a little later in November in the central sierra, and not until late in January for Monitor and Luther Passes. The northern routes were reopened in May, and the southern ones somewhat earlier.

On many of the routes maintained during the winter there were temporary closures, most of them ranging from two to six days, during periods of heavy snow or poor visibility.

The Santa Monica-San Diego Freeway interchange in Los Angeles. The view is northward along the San Diego Freeway.

Motor grader is used to remove icepack.

"Sno Blo" was redesigned and rebuilt at Headquarters Shop. It has approximately double the capacity of the old rotary plow.

MATERIALS AND RESEARCH

Control of materials for California's highway construction program has become a complex problem, involving both district construction and materials forces as well as the Materials and Research Department in Sacramento.

On each construction project the resident engineer's personnel perform a portion of the sampling and testing in order to have immediate knowledge of the materials entering the work. Additional and more complex control tests are performed in the 11 District laboratories.

District laboratory forces also obtain progress samples and perform progress tests, as a part of the independent record sampling and testing procedures required by the Bureau of Public Roads and the Division of Highways to provide added assurance of specified material quality.

The Materials and Research Department in Sacramento has a specific responsibility for testing, inspecting, and releasing the many manufactured products which are used in highway construction.

Two new district laboratories were completed and put into operation during the year. One of these, the District 4 Laboratory, located on the Bayshore Freeway right-of-way, is unique in that it was constructed directly under the freeway. A laboratory for District 7 and a new Headquarters Branch Laboratory were constructed on the right-of-way adjacent to the Santa Monica Freeway in Los Angeles.

Testing and Inspection

The magnitude of the testing program at the Materials and Research Department's Sacramento Laboratory is illustrated by the following statistics on some of the major testing items:

- 4,000 samples of soil and aggregates were processed
- 920 petrographic examinations were made
- 9,500 tests were performed on aggregate base, subbase, and asphalt pavement mixtures
- 12,300 samples of asphalt were tested
- 7,500 concrete cylinders were tested for compressive strength
- 960 samples of cement were tested
- 15,000 tests were performed on concrete, sand, and other materials

Inspection, which plays an important role in fabrication control and in the release of fabricated materials, accounted for another major part of the materials work. Following are the amounts of fabricated and manufactured products inspected prior to arrival on construction projects during the 1963–64 fiscal year:

Product	*Quantity*
Reinforced concrete pipe	202,016 lin. ft.
Clay pipe	18,603 lin. ft.
Steel pipe	208,927 lin. ft.
Miscellaneous iron and steel	1,620,085 lbs.
Guardrail	206,366 lin. ft.
Prestressed concrete members	56,179
Untreated timber	14,450 b.m.
Expansion joint	203,689 sq. ft.
Waterstop	16,200 lin. ft.
Corrugated metal pipe for culverts	497,414 lin. ft.
Structural steel	19,694,968 lbs.
Reinforcing steel	82,742,225 lbs.

Chemical analyses were also made on such items as paints, sealants, thermoplastics, and other miscellaneous materials.

The District laboratories reported an estimated 157,000 additional individual tests on aggregate base, subbase, bituminous mixtures, concrete aggregates and basement soils.

Sixty-seven settlement platforms and 109 piezometers were installed for embankment control at various locations throughout the State. Laboratory field forces installed 20,815 lineal feet of horizontal drains and cleaned 8,543 feet of existing drains.

Record Sampling and Testing

Record sampling and testing is carried on by both the district and headquarters laboratories. The district forces obtain samples and make tests during the progress of the work. The Materials and Research Laboratory takes final record samples, obtains thickness measurements of various layers in the pavement structural section, and makes confirming tests on a percentage of the final samples.

District laboratory personnel accounted for taking and performing tests on a total of 8,200 progress samples. Headquarters forces made 2,658 final record tests on samples taken from 1,899 sampling locations.

Preliminary Investigations

The district forces do the bulk of the routine investigations during the planning and design stages of projects

District 4's unique new materials labaratory, constructed under the James Lick Memorial Freeway in San Francisco, is well equipped to handle the large volumes of samples that must be tested.

whereas headquarters laboratory, with its large drill rigs, is called in to do jobs requiring heavier and more specialized equipment.

The districts reported that during the fiscal year they drilled holes totaling 148,733 feet in their sampling operations.

Headquarters forces made 125 borings for a total footage of 13,236 feet. This included 2,366 feet of soil samples, 3,030 feet of rock cores, and 7,840 feet of rotary drilling.

The geology unit of the laboratory made 23 seismic, resistivity, or geologic investigations in eight districts. These investigations pertain primarily to cut slope design and rippability of inplace rocky formations. The soils mechanics laboratory prepared 43 reports of embankment investigations.

The traveling deflectometer was used to obtain 21,250 individual pavement deflection measurements on 45 different projects involving 200 miles of roadway, 65 miles of which was city streets and county roads. Data from this instrument were used to make recommendations for reconstruction of roadways.

Research Projects

More than 200 research projects, both large and small, were processed during the fiscal year. In the area of foundation work, studies included the effect of size and type of soil sampler on soil disturbance, and related soil strength; strength of compacted soils; effect of sand drains on rate of settlement and rate of increase in strength of soft foundation soils; use of nuclear equipment to determine soil moisture and density; and several geologic studies including the development of a quantitative procedure to identify soil and aggregate minerals by X-ray diffraction.

A joint research program with the Department of Water Resources is being conducted to determine the properties of various nuclear systems to measure soil density. For the first time a nuclear gauge is being used to determine soil moisture and density on a project under construction in District No. 1.

The construction of high fills has been under study, since some future projects anticipate construction of 300- to 400-foot-high fills. Two fills, 190 and 260 feet high, on the San Luis Dam relocation project in District 10 have required instrumentation to determine where plastic flow is occurring within the fill mass.

On this same project, in cooperation with the Bridge Department, a total of 116 soil and concrete pressure cells along with 10 settlement platforms were installed in connection with the arch culvert.

The economical use of materials is the subject of continuing research. Serpentine aggregates are plentiful in California but have widely varying resistance to weathering; therefore, a research project has been carried on attempting to correlate an artificial weathering of serpentine, as well as other aggregates, with that occurring due to natural causes.

A continuing cooperative project with the University of California is designed to develop and use instrumentation capable of recording subaudible noises emitted by unstable rock masses. The application of this method to the predetermination of potential slide areas is currently being studied.

Work has continued on improving techniques to identify clay minerals by use of X-ray diffraction apparatus and analysis by differential thermal techniques.

Special studies have been made of Swedish foil-type soil sampler which was designed to obtain continuous undisturbed samples of soft foundation soils. Closely coupled sample tubes, 10 feet long, are pushed into the ground, and ribbon foil lining reduces to a minimum the disturbance to the sample and assures 100-percent recovery.

An operation has been undertaken involving lime treatment of a potentially unstable embankment near Whitmore Maintenance Station on Interstate Highway 80.

Studies are continuing on the durability and adhesion of asphalts. Various test methods for measuring the percentage of stripping of asphalt from aggregates in the presence of water are being evaluated.

Two experimental road test sections have been constructed to test methods

of preventing reflection cracking in bituminous, resurfacing, overlays. A study was made comparing the uniformity of bituminous paving mixtures as spread by different makes of paving machines.

Studies of the results of the AASHO road test were completed and a revised design method for structural sections of flexible pavements was submitted to and approved by the Design Department.

Research is continuing on the development of a flexible pavement design procedure based on the resiliency of the structural elements. The project includes a study of 25 different flexible pavements throughout the state to determine the effect of load applications and the changes in physical properties of the asphalt binder on the life of the pavement. Concurrent studies are being carried on at the University of California to evaluate the fatigue life of bituminous pavements.

A special investigation was carried on to compare the destructive effect of flotation (wide base) tires and dual tired systems.

Tests of various types of bridge bearing pads were continued; studies of creep and stresses in a precast, prestressed concrete girder without end blocks were made in a fabrication plant; tests were continued to evaluate epoxy as a shear connector, in lieu of welded studs, for composite beams; tests were performed to evaluate the seam strength of aluminum culvert pipe; comparison tests of bridge roller bearings were completed, and special laboratory fatigue tests of overlays for steel decks were performed.

A project to develop a high-speed method for measuring pavement irregularities and profiles was initiated; in cooperation with the Bridge Department, instrumentation was provided for stress studies of two bridge structures and an arch culvert; a project to develop warning system for icing was started; substantial progress was made in evaluating traffic counters; and assistance was given to the Bridge Department in studying the use of insulation for bridge decks.

Studies of freeway noise as related to design were continued and additional data on truck muffler noise were obtained.

Field and laboratory studies of new sign materials were conducted; dynamic impact tests on various types of barriers and bridge rail were performed in cooperation with the Traffic and Bridge Departments; studies were made to develop and evaluate special lane barriers for merging traffic; and a project for study of various glare shield materials was initiated.

A project was carried on to develop welding techniques and procedures for newly marketed high-strength reinforcing steels, as well as new alloy steels. A project has been started to test the fatigue properties of an orthotropic bridge section.

Studies were continued on the use of ultrasonic inspection of welds and the use of protective coatings for steel structures.

Research continues on paints, adhesives, thermoplastics, marking materials, and joint sealants. Field evaluations have been made on many traffic paints. A special study using inorganic zinc silicate paints was made on a coastal bridge. Several installations of various reflective pavement markers have been made for evaluation purposes.

Use of the X-ray diffraction equipment is being expanded to include the screening of cement samples, and thereby reduce the number of chemical analyses necessary to control the quality of cement.

Corrosion research has been continuing to determine the causes and methods for inhibiting the corrosion of reinforcing steel. A report has been written on the completed work.

The effects on concrete quality of water-cement ratio, hydration, and cement factor are also being studied. Several field surveys on corrosion problems have been made during the year for other State agencies.

A project to determine the effect of various factors on the shrinkage of concrete was carried out for the Department of General Services. Among the items evaluated were admixtures, dirty aggregates, lightweight aggregates, and aggregates from various sources including Spain and Mississippi.

Bimetal thermometers, used by construction inspectors, are checked for accuracy.

A second test section to evaluate shrinkage-compensated cement was incorporated in the Lodi Bypass project. An experimental section was established on the Fresno Bypass to evaluate polyethylene strips used for both the transverse and longitudinal joints in concrete pavement. Research studies affecting the quality and durability of concrete included the ef-

The electrical resistivity of concrete is measured to determine the relative conditions of corrosion potential to reinforcing steel by this instrument developed by the Materials and Research Laboratory.

fect of steam curing on volume change of mortar, the sulfate resistance of portland cement, and the mortar strength of concrete sand. Several other projects concerning concrete are continuing. These include restrained shrinkage of concrete, abrasion resistance, and the effects of air entraining agents.

A new test method was designed to evaluate epoxy resin systems at low temperatures by flexural creep measurements.

Training

The Materials and Research Department's training course, "Procedures, Testing Methods and Use of Materials for Highway Purposes," was conducted on four occasions and was attended by 74 engineers. In addition 39 engineers and technicians were given a special training course in inspection of materials by the Los Angeles branch laboratory. The district laboratories have also been quite active in training engineers and technicians for materials inspection on highway construction projects. Seven districts carried on such training programs, which were attended by 319 people and involved 11,920 man-hours of training.

Headquarters laboratory continues to be popular with visitors from colleges, counties, federal agencies, other state agencies, and particularly foreign visitors. There were 79 foreign engineers, representing 18 countries, among the visitors during the year.

Technicians use nuclear moisture density gauges in field comparisons with conventional methods.

The new model traffic striper is shown in operation in Oakland.

EQUIPMENT DEPARTMENT

The Division of Highways operates a fleet of 10,604 units of highway equipment. At the end of the 1963–64 fiscal year, this fleet comprised 7,128 automotive and 3,476 maintenance and construction units.

The expense of equipment operation is financed through an equipment rental system. During the 1963–64 fiscal year, rental was based on the equipment's depreciation, its repair cost, and indirect charges such as accident damage and loss, insurance and administration. These rental charges, plus the funds derived from the sale of retired equipment are sufficient to recover the original cost as well as normal Equipment Department operating costs.

Improved Snowplow

During the past fiscal year the Equipment Department completed studies, design and construction of an improved rotary snowplow. This unit, the Snow-Blo, was tested this past winter and is capable of completing a great deal more work than previous units.

A standardized truck body was designed especially for repairs to median barriers and roadside fencing. This unit provides for more efficient fence and barrier repair and improved crew safety.

An asphaltic heating kettle has been designed which can serve as a multipurpose unit capable of distributing hot or cold asphaltic emulsions, hot road oils, and may be used to heat asphaltic crack filler.

A combination spraying and watering truck has been developed for landscaping work. This unit has an automatic proportioning system that allows the operator to change types and amounts of additives by selection from concentrate tanks. It is antici-

pated that these improvements will result in considerable savings in materials and time.

Preliminary work is being carried out on the perfection of a windshield deicing system for snow removal equipment. This unit employs chemicals as a melting and cleaning agent.

During the past year repair and fabrication of equipment has been closely analyzed. Assembly line methods have been installed wherever feasible. Field mechanics have been strategically placed to give more economical service. Work weeks have been changed to reduce overtime. Better tools and equipment have been provided. The result of this emphasis has been a reduction in costs not only on repair work but also on equipment fabrication. One example of this is the assembly cost of four-cubic-yard maintenance trucks. A reduction of $1,700 per unit has been realized by using assembly line methods.

Average Repair Cost

The average repair cost per unit per year during 1963–64 was $400. This is a reduction of $34 per unit below the previous year and an $80 per unit reduction for the past 10 years.

In an effort to reduce equipment recordkeeping and adapt it to data processing, the department's management set up several new procedures.

One was to provide for renting the automotive equipment on a mileage basis, and maintenance and construction equipment on a hourly basis. The new rental rates include fuels, oil, and other operating charges. This eliminated the need of the operating departments to set up separate rents to include the operating expense such as gasoline, oil, grease, etc. Only one office (the Equipment Department) will be charged with setting rates which will be standard on a statewide basis. The new rates were placed in effect on July 1, 1964.

During the past year the Equipment Department has written specifications for 344 units of equipment. Specifications are written in a manner to permit the various manufacturers to compete in bidding.

During the last half of the fiscal year, the first half of the Equipment Department Rental Equipment Catalog was completed. This catalog, when completed, will illustrate and describe all the types of equipment available from the Equipment Department. The first section, describing automotive equipment, is published and in use. Completion is expected by early in 1965.

Volume Buying Brings Saving

The continuation of volume purchasing has resulted in a considerable saving. During the past year $6,987,600 was expended to purchase automotive and construction equipment as additional and replacement units.

This year one contract was issued for all standard maintenance trucks. By mass buying, 215 trucks were purchased, resulting in a savings of approximately $500 per truck.

The Equipment Department disposed of 437 obsolete units with sealed bids during the 1963–64 fiscal year for a total of $105,390. This amounted to approximately 16.8 percent of the capital cost of these units.

The technical research and training section has continued in equipment research and operation problems. This has involved fuels and lubricants and the preventative maintenance program. The section has handled technical training activities. Research problems included a fire problem with asphalt kettles and investigation for corrective maintenance problems associated with crankcase pollution control devices.

A paper, "A Preventative Maintenance Program for Highway Maintenance Equipment," was prepared and presented at the 43rd annual meeting of the Highway Research Board. The facts presented illustrated the advantages and economies experienced by the Equipment Department during the past 10 years as a result of the organized preventative maintenance program.

During the 1963–64 fiscal year studies were completed on the economical life of automotive equipment units. As a result of these industrial engineering studies and those completed by other state agencies, the vehicle replacement policy has been revised. It provides for replacement of automotive equipment at any time, regardless of age or mileage when it is economical to do so. The new policy means that the equipment will be utilized only for the most economic period of its life.

The Procurement Section, during the past fiscal year, processed 289 fewer requisitions and 4,247 fewer purchase orders, under a policy of consolidating orders for parts and supplies.

The physical plant consists of 12 major shops and 17 subshops to serve

EQUIPMENT DEPARTMENT SUMMARY

	June 30, 1963	*June 30, 1964*
Equipment repairs	$4,426,936.80	$4,246,330.29
Miscellaneous expense	659,914.06	825,887.30
Administration and other expense	1,210,311.00	1,273,944.69
Depreciation Expense	3,912,864.82	4,313,748.03
Total expense	$10,210,026.68	$10,659,910.31
Total income	10,144,578.25	10,933,862.67
1963–1964	−$65,448.43	+$273,952.36

Inventory: The original investment in equipment is as follows:

TRUCKS AND PASSENGER VEHICLES

All trucks—½ to 15 tons	$17,413,610.95
Buses, jeeps, and station wagons	590,256.55
Passenger automobiles	4,511,948.44
	$22,515,815.94

MAINTENANCE AND CONSTRUCTION EQUIPMENT

Motor graders	$4,958,394.89
Rotary snowpows (truck mounted)	1,685,968.87
Rotary snowplows (grader mounted)	131,649.78
Loaders	2,160,606.18
Shovels, power	416,739.70
Tractors	916,041.57
Snowplows, push	795,585.64
Compressors	398,177.18
Miscellaneous other equipment—rollers, mixer, trailer, pumps, drills, mowers, etc.	5,927,581.64
	$39,906,561.32

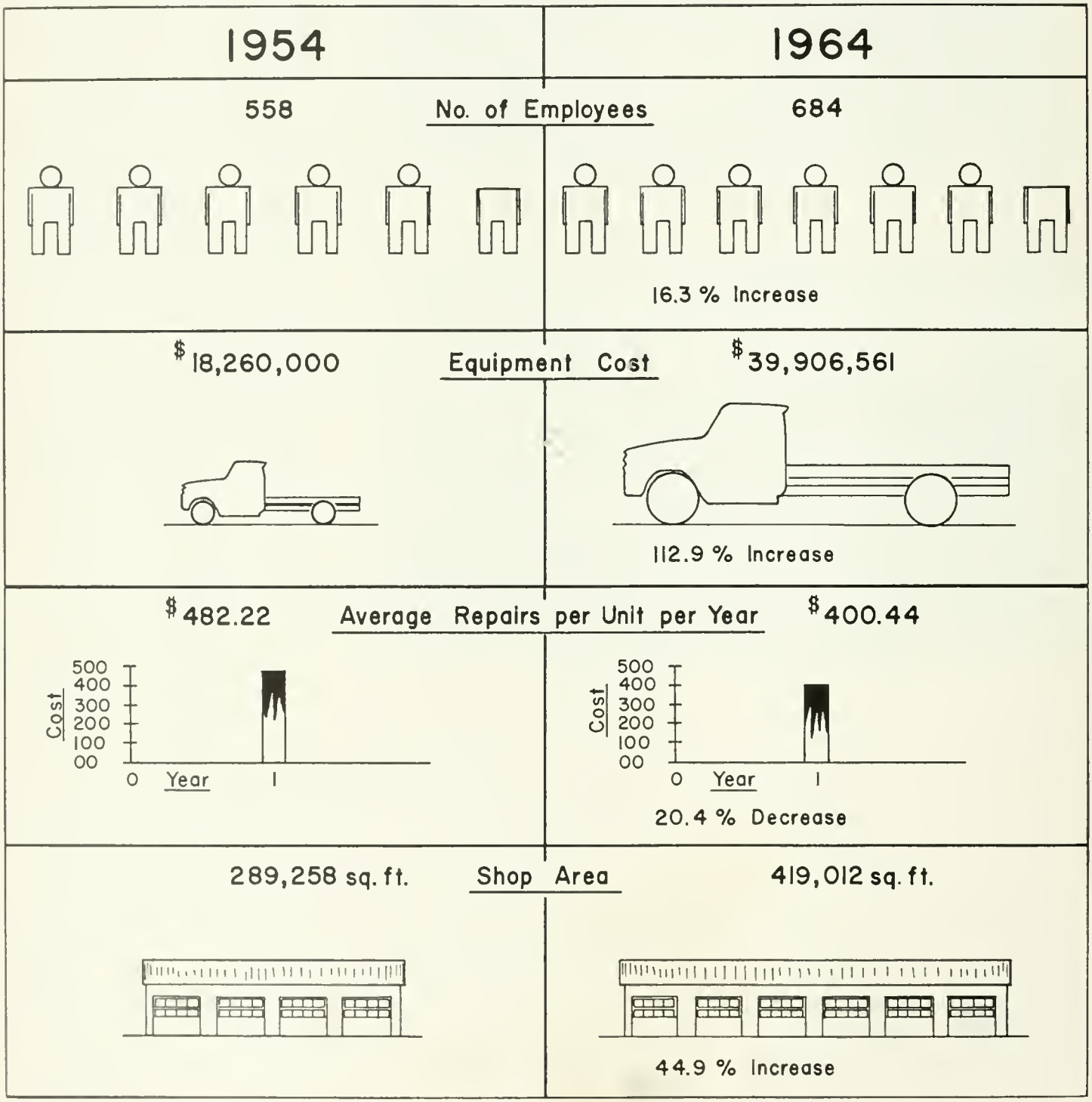
the 11 highways districts and the Division of Bay Toll Crossings. These shops, in addition to normal repair and fabrication, also handle special work such as maintenance and repair of movable-span bridges, pumping plants, ferryboats, and other miscellaneous work. Field forces are provided to accomplish emergency repairs on the road.

Construction was started on a new facility for Shop 3 at Marysville.

Plans and specifications for construction of a new shop at San Leandro to replace the existing Shop 4 at Oakland were completed.

These new shops, plus the others constructed in the past 10 years, have assisted in providing a more economical repair cost per unit.

During the past 10 years the Equipment Department has grown with the workload of the Division of Highways. The accompanying diagram (below) shows this growth. During this period repair costs per vehicle per year have been reduced by $80 per unit, while the total increase in equipment value has been 113 percent. This has been accomplished with an increase of only 16 percent in personnel.



Administration

- *The Assistant State Highway Engineer, Administration, is in charge of the following functions: office engineer; city and county projects; service and supply; management analysis; and systems research*

OFFICE ENGINEER

The office engineer is responsible for a wide range of administrative activities, including preparation, review and processing of plans, specifications, estimates, and bid and contract documents; budget and expenditure control; administration of federal funds; industry contacts; bidder prequalification records; reports and statistics; and mail and general files.

Budget and Project Control

Engineering control of the state highway budget involves procedures to insure that provisions and amounts specified in the budget are observed; preparation and processing of contract documents; preparation of financial documents submitted to the California Highway Commission; issuance of work orders; and maintenance of construction records.

During the year 500 financial resolutions were prepared for commission action; 559 projects were advertised for bids with an estimated cost of $390,390,900; and 525 projects were determined to be satisfactory for recommending contract award.

In addition to the major contract work, the financing of 380 minor and informal contracts with a total value of $569,800 was cleared.

More than 10,000 expenditure authorizations were coded for use with the new EDP accounting system to be placed in operation on July 1, 1964.

Plans and Estimates

Preparation of projects for advertisement requires reviewing and correlating the plans and specifications to assure that they are in agreement. Estimates of cost for all projects are reviewed periodically prior to opening of bids so that estimates can be adjusted to conform with prevailing construction costs whenever necessary.

Title sheets are prepared for the larger construction projects and location maps for many of the smaller projects; last-minute changes or additions are made to the detail plans for such projects prior to advertising; and place "as built" changes on the contract plans. Standard construction plans, three series of district and metropolitan area maps, various state maps including the road map supplementing the annual report of the division and the progress map, California freeway and expressway system, are prepared and maintained; and charts and maps for other units and occasionally for other state agencies are prepared.

A monthly project record-consolidated status estimate, used in conjunction with the progress and payment of all regularly advertised going contracts, is prepared. An annual tabulation entitled "Contract Item Data" is prepared as an administrative aid and management tool.

Specifications

The Division of Highways *Standard Specifications* for highway projects was revised and republished, effective July 1964. The previous edition was dated 1960. These standards are used not only by the state but also by many counties, cities, and other agencies and guides and references for highway type of work.

Specifications for 559 projects were prepared during the year.

Reports and Statistics

Statistical records were kept on highway construction contracts awarded, numbering 525 during this fiscal year, the quarterly California Highway Construction Cost Index was prepared and periodic reports are prepared showing the value and prog-

Bridge (right) was constructed on new alignment over the Tuolumne River near Waterford by Stanislaus County under the federal aid secondary program. It replaces a bridge built in 1914 which is now inadequate for present day traffic.

STATE HIGHWAY MILEAGE BY SURFACE TYPES

Type	NORTH			SOUTH			TOTALS		
	Outside cities	Inside cities	Total	Outside cities	Inside cities	Total	Outside cities	Inside cities	Grand total
Concrete	506.892	171.809	678.701	565.760	420.662	986.422	1,072.652	592.471	1,665.123
High bituminous	4,323.235	513.653	4,836.888	3,434.526	607.572	4,042.098	7,757.761	1,121.225	8,878.986
Low bituminous	1,422.743	28.793	1,451.536	850.979	15.446	866.425	2,273.722	44.239	2,317.961
Oiled earth, gravel	492.050	0.714	492.764	584.700	3.738	588.438	1,076.750	4.452	1,081.202
Graded and drained earth	31.041		31.041	26.300		26.300	57.341		57.341
Bridges	71.171	35.305	106.476	34.419	31.659	66.078	105.590	66.964	172.554
TOTALS—CONSTRUCTED ROAD	6,847.132	750.274	7,597.406	5,496.684	1,079.077	6,575.761	12,343.816	1,829.351	14,173.167
Unconstructed road	1,177.074	145.855	1,322.929	703.720	217.274	920.994	1,880.794	363.129	2,243.923
TOTAL HIGHWAY SYSTEM	8,024.206	896.129	8,920.335	6,220.404	1,296.351	7,496.755	14,224.610	2,192.480	16,417.090

ress of budgeted and nonbudgeted programs. The Statistical Supplement to this annual report is another reporting function.

Prequalification of Contractors

Prequalification is required of all contractors who desire to bid on state highway projects estimated to cost more than $50,000. The prequalification rating, representing the maximum bidding capacity for each of the several types of work which a bidder is capable of undertaking, is established from a review of each contractor's statement of experience and financial condition.

Seven hundred seventy-four contractors were prequalified on July 1, 1964, to bid on the various types of state highway construction, with a bidding capacity of $2,543,966,000, which is $11,085,000 more than a year ago, though there are 59 fewer prequalified contractors.

In arriving at a combined bidding capacity, no portion of the individual ratings in excess of $20,000,000 has been included.

The following tabulation gives the number of contractors prequalified by the Division of Highways on July 1, 1964, arranged by the several brackets if bid ratings:

Rating	*Number of Contractors*
$10,000,000 and over	81
5,000,000 to $10,000,000	146
2,500,000 to 5,000,000	236
1,500,000 to 2,500,000	299
1,000,000 to 1,500,000	366
500,000 to 1,000,000	508
250,000 to 500,000	647
100,000 to 250,000	752
50,000 to 100,000	774

Bids and Bidders

The average number of bidders per project during the year was 5.4, slightly higher than last year's level of 5.3. The highest monthly average of 6.6 was in January 1964. The low of 4.5 was in July 1963.

The contracts awarded during the fiscal year have been arranged in eight value ranges as shown in the accompanying "Contract Value Range" table. Included in the table are the number and total value of projects making up each bracket and the percentage each bears to the total.

CONTRACT VALUE RANGE

	Number of projects	*Percent*	*Value of projects*	*Percent*
Under $50,000	223	42.5	$4,408,925	1.3
$50,000 to $100,000	64	12.2	4,517,587	1.3
100,000 to 250,000	86	16.4	14,906,706	4.3
250,000 to 500,000	50	9.5	16,995,658	5.0
500,000 to 1,000,000	30	5.7	21,415,768	6.2
1,000,000 to 2,500,000	24	4.6	39,785,781	11.6
2,500,000 to 5,000,000	29	5.5	111,813,647	32.6
Over $5,000,000	19	3.6	129,008,217	37.6
Total	525	100.0	$342,852,289	100.0

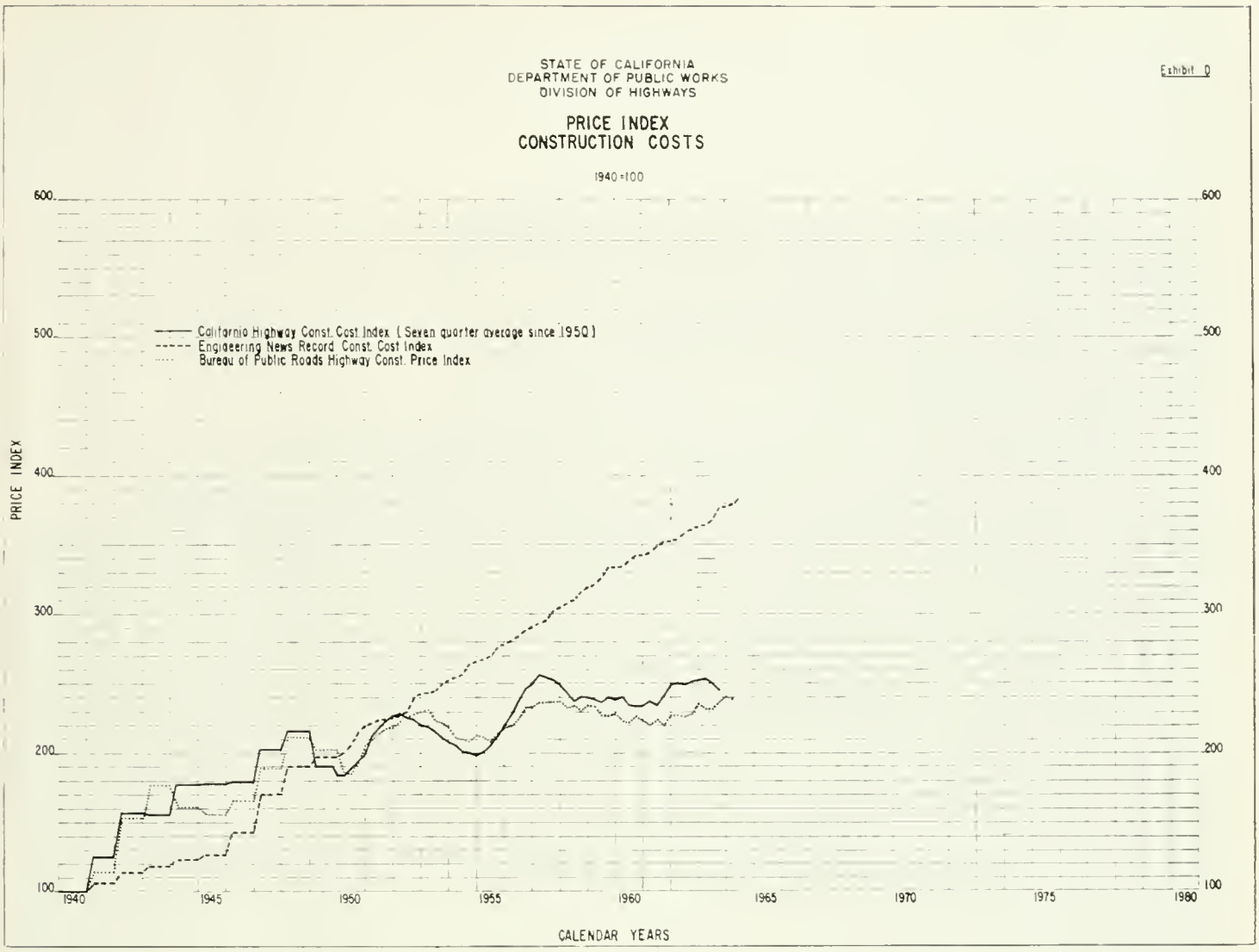
Street and Highway Mileages

Various highway and street mileages, with which the Division of Highways is directly or indirectly concerned, are shown below:

	Miles	*Miles*
Total State Highway System (including portions of city streets and FAS system)		16,417
Highways proposed for construction where roads do not exist		2,244
Constructed state highways		14,173
Federal-aid System		
Primary rural (12-31-63)	8,043	
Primary urban (12-31-63)	1,610	
Total		9,653
Federal-aid interstate system (included in above)		2,177
Federal-aid secondary system (6-30-64)		
On state highways	3,527	
On county roads	9,129	
Total		12,656
County maintained system (6-30-64)		70,646
City streets (estimated 12-31-63)		34,709
City streets on state highway system		1,829

Construction Cost Index

The California Highway Construction Cost Index reflects changes in highway construction costs. The index is founded upon weighted average contract prices for seven principal construction items in place, all referred to the base year of 1940 with a value of 100.



The fiscal year began with an index value of 249.5 in the third quarter of 1963, dropped to 243.0 in the following quarter, increased slightly to 246.1 in the first quarter of 1964 and again to 248.7 in the second quarter of 1964. The average value for 1963 is 246.8.

The above graph shows a comparison between the California index, the Bureau of Public Roads Index and the Engineering News-Record Construction Cost Index. Plotting of the California Index has been changed to an average basis.

CONTRACTS BY TYPE

The following tabulation gives the number of contracts with mileage by types awarded during the 1963–64 fiscal year.

Number of contracts		*Centerline miles*
46	Portland cement concrete	206.3
152	Asphalt concrete	978.7
9	Road mix	13.3
6	Seal coat	175.9
2	Grading	1.3
87	Traffic signals and lights	.....
27	Bridges	.....
131	Miscellaneous	.....
460	Total	1,375.5

NOT ON STATE HIGHWAY SYSTEM

County Roads—Federal Aid Secondary

Number of contracts		*Centerline miles*
1	Portland cement concrete	1.1
32	Asphalt concrete	102.2
2	Road mix	8.1
2	Seal coat	4.3
5	Grading	24.8
6	Bridges	.....
14	Miscellaneous	.....
62	Total	140.5

STATE PARKS, ETC.

Number of contracts		*Centerline miles*
1	Asphalt concrete	3.0
1	Miscellaneous	.....
1	Traffic signals and lights	.....
3	Total	3.0

Federal Aid

A total of $314,631,779 in federal aid funds was apportioned to California for 1964-65 under the Federal Aid Highway Acts of 1961 and 1962. This included $22,069,229 for primary highways, $10,198,330 for secondary routes, $26,214,680 for urban routes and $256,149,540 for interstate highways. The federal matching ratio on primary, secondary and urban projects is 59.68 percent; on interstate projects, 91.59 percent.

At the start of the fiscal year, construction was in progress on 111 contracts totaling $434,981,000, of which $329,832,000 were federal aid funds.

There were 84 construction contracts involving $12,160,000 of primary funds, $23,635,000 of urban funds and $110,838,000 of interstate funds completed during 1963-64. These amounts, together with the required state matching funds, bring the combined total cost of such improvements completed during the year to approximately $190,586,000.

There were 118 contracts awarded with a total cost of $312,256,000 exclusive of preliminary engineering, involving primary, urban and interstate federal aid funds totaling approximately $234,846,000.

Seventy-six of these contracts provide for improvements on the national system of interstate highways with a total cost of $189,693,000 of which the federal share amounts to $169,567,000.

Right-of-way project agreements with the Bureau of Public Roads increased the total of interstate federal aid funds under agreement for participation in right-of-way acquisition costs by $102,507,937 to a total of $542,156,108.

Industry Contact

The industry contact function of the Division of Highways includes collection of prevailing wage contract data from contractor and labor organizations; collection of information for the establishment of equipment rental rates to be used on force account work; and the following other activities.

Service Contracts. 4,880 service contracts were processed, involving a total expenditure of $5,948,000.

This type of contract is used for renting equipment and obtaining a wide variety of services. Its use is confined to work not covered by the State Contract Act and not adaptable to other prescribed procedures.

The principal use of service contracts, involving an expenditure of nearly $1,611,200, was for the rental of equipment for highway maintenance, for use by honor camps, and for occasional day labor projects.

Minor Contracts. Small projects for which the cost will not exceed $5,000 are handled by the districts. A total of 380 minor contracts with a value of almost $569,750 were awarded during the fiscal year. The average per contract was approximately $1,500.

Standard Agreements. Certain types of personal services are obtained under standard agreement. During the fiscal year 129 standard agreements were processed covering such services as appraisers and expert witnesses in right-of-way matters and professional consultants in unusual design and economic investigations.

Right-of-way Clearance Contracts. As in past years, contracts were awarded to clear rights-of-way in advance of construction. There were 464 contracts totaling $987,200 awarded for the demolition of buildings. Another 14 contracts totaling $154,400 were awarded for altering and moving buildings, relocating irrigation systems and fences, and drilling wells.

CITY AND COUNTY PROJECTS

The Collier-Unruh Local Transportation Development Act, which became effective on September 20, 1963, greatly increased the responsibilities of the division's City and County Projects Department. This function includes administration of the apportionment and expenditure of the portions of the gasoline taxes that are paid to the cities and counties. Other activities involve administration of the federal aid secondary highway program, the federal aid secondary urban extension program, the local street and highway flood relief program and the updating of the division's county road maps and tabulations.

City and County 1.04-cent Program

The Collier-Unruh Act, as of October 1, 1963, increased the motor vehicle fuel tax from 6 cents to 7 cents per gallon along with other changes and made the equivalent of these new funds available to the cities and counties. A new program of apportionment was provided under Section 186.1 of the code whereby 1.04 cents per gallon of gasoline taxes collected is apportioned and paid monthly to eligible cities and counties through a four-step formula using lump sums, county vehicle registrations, assessed valuation of property and city populations. The payment of a part of these funds is limited under Section 186.5 of the code to those cities and counties that match them with funds derived from other than the Highway Users Tax Fund or the State Highway Fund.

Though the new 1.04-cent funds do not require formal budgeting and prior approval by the department, the administration of the program does require the review of each improvement to verify conformance with the requirements of the act in regard to eligible work, standards of design and location on an approved select system of roads and streets. Plans for 418 projects were reviewed by district and headquarters engineers, and many other projects were reviewed at the site of construction. The expenditure of these funds and those considered as matching are reported to the department in two annual reports; a matching fund report and a fully detailed report of all expenditures on the system.

During the portion of the initial fiscal year that this act has been in operation, $24,310,000 was apportioned to the cities and $10,774,400 to the counties. Of this total, $1,199,600 was available for expenditure without matching. The remainder will require 50 percent matching during the year of expenditure but only $4,279,700 had been expended by the end of the fiscal year. Since reported matching expenditures totaled $48,368,100, there is a

A safety roadside rest on the two-lane Route 49 expressway east of Sierra City in Sierra County. It is one of 24 such facilities throughout the state now used by motorists. Seven more are under construction and work is scheduled to begin on an additional 26 in 1965.

Seattle Public Library
FEB 8 1965

sizeable excess which is eligible for matching future expenditures of apportioned funds.

City 0.725-cent Program

The former ⅛-cent gasoline tax that was apportioned quarterly to the cities from the State Highway Fund was increased 1/10 cent by the Collier-Unruh Act to 0.725 cent per gallon. These moneys are sometimes referred to as the "2107 funds" after that section of the Streets and Highways Code providing them.

The allocations of funds to cities for engineering costs in respect to city streets remained unchanged under Section 2107.5. This allocation ranges from $1,000 to $20,000 annually to each city, and totaled $1,338,500 during the 1963–64 fiscal year.

City budgets approved by the division for the expenditure of ⅛-cent and 0.725-cent funds during the 1963–64 fiscal year included $28,578,100 for construction, $15,925,400 for maintenance, and $7,491,800 for rights-of-way. One of the changes provided by the Collier-Unruh Act was a reduction in the percentage required to be expended for construction and rights-of-way from 60 percent to 40 percent.

State-allocated ⅛-cent and 0.725-cent funds available to cities for budgeting during the fiscal year were:

Unbudgeted funds in city treasuries and in the State Highway Fund, June 30, 1963	$9,100,800
Apportionments during the fiscal year	42,131,600
Savings on completed projects and canceled projects and interest and rental receipt accruals	9,704,800
Total available for budgeting during the fscal year	60,937,100
Actual amount budgeted	51,995,300
Carryover for budgeting in the 1964–65 fiscal year	8,941,900

During the year 557 sets of plans, specifications, and estimates were reviewed and approved for construction. These projects provided for the improvement of 188 miles of streets at an estimated cost of $57,064,700. About 70 percent of the projects were approved by the districts, a procedure inaugurated at the beginning of the year in order to improve service to the cities.

New Cities and Populations

Seven new cities filed incorporation papers with the Secretary of State during the fiscal year, bringing the total number of cities in California to 389 as of June 30, 1964. There were 1,137 city annexations during the same period. The new cities and dates of incorporation were: Cotati, Sonoma County, July 16, 1963; Desert Hot Springs, Riverside County, September 24, 1963; Ridgecrest, Kern County, November 29, 1963; Clayton, Contra Costa County, March 18, 1964; Hawaiian Gardens, Los Angeles County, April 9, 1964; Tiburon, Marin County, June 23, 1964; Lomita, Los Angeles County, June 25, 1964.

The population increase of incorporated territory during the year is summarized as follows:

As of June 30, 1963	12,517,780
By annexation	35,277
By special federal census	18,105
By Department of Finance estimates	519,991
By new incorporations	13,338
As of June 30, 1964	13,104,491

Rood and Street Systems

The Collier-Unruh Act provided for a new "select system" of county roads to replace the former county primary road system and a new "select system" of city streets to replace the former major city street system.

Initially, as of January 1, 1964, the "select system" consisted of the roads and streets system of "arterials" and "collectors" contained in the Report of County Road and City Street Deficiencies prepared by the division in 1959 for the Legislature in compliance with Senate Concurrent Resolution 62. The Collier-Unruh Act required that each city and county propose a new select system for the Highway Commission approval prior to October 1, 1964. The commission is required to approve or modify all proposals by April 1, 1965.

The act specifies criteria designed to create a system of arterial highways supplementing the state highway system, while at the same time allowing for inclusion of collectors. The entire system, including the state highways, may not, except under special conditions, include more than 50 percent of the entire system of public thoroughfares in any city or county.

With the approval of the select system in progress, the division is embarking upon the task of amending its record maps which are kept up to date for use by those whose functions require information concerning county roads, city streets and city limit lines. These revisions are in addition to those required annually by the Collier-Burns Highway Act of 1947. Fifty-seven counties reported changes in their mileage of maintained roads as follows:

	Miles
New roads	1,076.94
Deletions (by annexations)	915.77
Net increase	161.17
New total as of June 30, 1964	70,646.30

During the fiscal year, 316 miles of local roads were added to the federal aid secondary highway system, bringing the total in that class to 9,152 miles. At the same time, 70 miles of state highways were added to the federal aid secondary system, making that total 3,527 miles.

FAS Program

During the fiscal year, 48 county FAS contracts were awarded at a total cost of $19,092,100. These funds covered construction on 136.018 miles of road and 20 bridges.

California received $10,013,700 of federal funds for secondary highways authorized for the 1964-65 fiscal year. In accordance with state statute, 87½ percent, or $8,762,000 was reapportioned to the counties. The Division of Highways retains 11 percent of the total allocation for construction on state highways on the federal aid secondary system, and 1½ percent for planning purposes. During the 1963-64 fiscal year, $429,200 of "state share" funds were utilized for the improvement of 11.2 miles of state highways.

A total of $4,151,000 for the 1964-65 fiscal year was provided from the State Highway Fund in accordance with state law to pay the counties' share of the FAS construction projects up to a maximum of $100,000 per county.

Urban Extension Program

The federal aid secondary urban extension program authorized by Section 143.3 of the Streets and Highways Code in 1959 is summarized as follows:

Fiscal year	*Projects*	*State highway funds* *To cities*	*To counties*
1960–61	5	$456,500	$406,500
1961–62	10	591,500	761,250
1962–63	4	106,000	269,500
1963–64	6	866,800	975,200
1964-65	13	2,064,700	1,240,150
1960–65	38	$4,085,500	$3,652,600

The above funds represent allocations made by the Highway Commission on an equal matching basis to qualified cities and counties that made application on the basis that the local road or street projects were considered to be more important to the local community than improvements which would otherwise have been made to state highways in the same area.

Flood Damage Repair

The duties of the Division of Highways include the investigating and reporting on flood damage suffered by local agencies to establish eligibility under the State Emergency Flood Relief Law, the federal aid highway acts and the federal disaster relief program.

Twelve counties, 10 cities and 2 special districts applied for financial assistance in costs of about $6,550,000 for repair and restoration of roads, streets and bridges damaged or destroyed by the storms beginning in October 1962 and January 1963.

"State of disaster" proclamations by the Governor resulted in federal financial assistance being made available to the City of Los Angeles and to Culver City in emergency measures made necessary by the rupture of the Baldwin Hills Reservior Dam, and to Crescent City in emergency measures made necessary by the seismic sea wave of March 28, 1964.

A nearly completed four-lane divided section on Poway Road in a rapidly developing area north of San Diego. This project was financed under the federal aid secondary county road program.

SERVICE AND SUPPLY

Service and supply activities of the Division of Highways fall generally into the following seven primary areas:

1. *Specifications*, or establishing standards for property to be purchased.

2. *Acquisition* of property by procurement through the Office of Procurement, General Services.

3. *Traffic management*, or the transporting of property from the point of purchase or storage to the point of need.

4. *Inspection*, or insuring adherence to purchase specifications.

5. *Identification*, or getting property under a standard system so as to facilitate identification.

6. *Storage and issue*, or the storing of necessary reserves of property and their distribution.

7. *Utilization*, or seeing that property is efficiently used and is suitably disposed of when no longer needed.

A general streamlining of the Service and Supply Department, including the use of scientific inventory control methods, is being undertaken. Studies are being made to utilize electronic data processing in the warehousing operation, with an ultimate goal of divisionwide use in property management.

Reproduction. Last year's record 7.5 million square feet of prints was equaled. The duplicating unit ran 21,800,000 impressions, up 45 percent from last year.

Photography. This year's 1,922 orders represent no significant change from last year.

Records Management. The North Record Center has 22,436 cubic feet of records, up 15 percent from last year. South Record Center received 700 cubic feet of new records and disposed of 600 cubic feet, and now has 4,300 cubic feet of records.

Supply

Procurement. The increase in procurement reflects the growth of the division. Warehouse purchases were up 14 percent to $5,800,000. Total purchases were up 3 percent to $15,800,000. Warehouse disbursements were up 10 percent to $5,700,000, while warehouse inventories remained approximately the same at $2,200,000. The resulting turnover factor of 2.6 is the best ever attained by the warehouses.

The growing use by the districts of the subpurchase order pad initiated last year is saving time, paperwork and expense. This method of expediting local purchasing is helpful to the field forces.

Warehouse Operations. The reduction of stockpiles of H-piling and beams has continued. Improved packaging and storing methods are being initiated. An example is the packaging of small construction stakes into cartons, which saves over 60 percent in warehouse space, as compared to the old method of using sacks, yet costs no more.

There were 35,386 requisitions filled (up 3 percent) for a total of 125,327 items (up 6 percent) at the warehouses. This required 14,863 shipments (up 5 percent).

Signs. The major sign purchasing contract was split to afford better competition and to provide more flexibility. There were 86,964 signs handled, up 29 percent from last year. The cost of the signs increased 24 percent to $2,138,903.

Nonrental Budget. Actual expenditures for nonrental budget items were about $925,000, up 4 percent from last year. The nonrental inventory as of June 30, 1964, was $16,066,000, up 5.5 percent.

Printing. Service and Supply provides the liaison service between the division and the Office of State Printing. There were 2,731 standard printing orders processed, a 6-percent increase over last year. Also, 131 "outside" orders were cleared for work by private firms.

MANAGEMENT ANALYSIS

The development of budget policies and procedures to include all personnel and related operating expenditures for the Division of Highways was completed and implementation started during this past year. The process developed thus far has facilitated the reduction of anticipated expenditures through the review of the manpower requests.

A Stenographers and Typists Manual has been developed, issued, and a means developed whereby periodic training is provided to the users of the manual, as well as a means of maintaining the manual in up-to-date form.

A comprehensive and far reaching study to determine the authorities and responsibilities of approximately 250 key people throughout the division was undertaken, from the State Highway Engineer to the resident engineer. This study should not only permit establishing in writing the respective authorities and responsibilities, and the delegation thereof, but should also provide a useful tool for the examination of procedures and the flow of work in the division.

Basic records usage studies were completed for three of the 11 highway districts and several special record studies were also completed. Included in the latter was a map and plans usage and retention pilot study.

An improved means of reporting disposition of records was developed. Study was commenced on the utilization of microfilm equipment for retrieval of records, as well as storage of records. This study is designed to realize the greatest present and potential use at the lowest possible cost by applying the recent developments in the microfilm field.

SYSTEMS RESEARCH

In collaboration with the Fiscal Management Department, a detailed study was undertaken of the division's labor cost codes (activity codes) with the objective of reducing the unusually large number of existing codes and still retaining a classified definition of overall work effort susceptible for meaningful analysis by management. A consolidation of new codes was written and placed in operation.

As a consequence of recommendations made by a private consulting firm and under policy direction of the Division of Evaluation Committee, a system of computer-produced management reports for key personnel in all functions of the division was implemented. Report formats were designed to accommodate departmental requirements. District and headquarters organization charts were coded to render a progressive reporting system.

. Planning

- *The Assistant State Highway Engineer, Planning, is in charge of advance planning, programs and budgets, design, traffic, and urban planning*

ADVANCE PLANNING

Advance planning involves processing project reports, coordinating route adoptions and freeway declaration procedures, processing freeway agreements, and coordinating the Division of Highways planning work with that of other state, federal, or local agencies.

Project Reports

Reports for 283 proposed projects were processed during the year, 199 of which were major projects.

A project report covers the engineering investigation and analysis of a specific project. This report discusses the need for and the type of the planned highway improvement and how it should be accomplished.

Project reports are required for all proposed improvements. They constitute a control mechanism in planning and budgeting, and provide information for basic design features. They are prepared in the district offices.

The reports are reviewed at the Sacramento headquarters where analysis by various departments is coordinated by the Advance Planning Section after field review.

Aerial mapping is being used more and more to evaluate topographic controls and expedite the preparation of project reports.

Freeway Routes

The development of an integrated system of freeways, one of the most important phases of modern highway planning, has been emphasized in California for many years. It involves consideration of community values and potential land uses, as well as traffic needs and benefits.

The Division of Highways informs all local authorities of the initiation of freeway route studies and of the general features of proposed freeway units as the studies progress. When sufficient information has been developed on a specific freeway project, a well-publicized public hearing is held in the general area to present the results of the study to local officials and the interested public; and to learn the local reaction to the project as well as to receive any information which may be pertinent to the routing. (Current commission procedural policy, which is contained in subchapter 4 of the California Administrative Code under which the Division of Highways operates in freeway route location matters, is included in the statistical supplement of the Annual Report.)

Transcripts of proceedings of public hearings, together with reports on the results of conferences, are made available to the Highway Commission for consideration in the determination of freeway routings.

During the 1963–64 fiscal year, the district staffs of the Division of Highways held 43 of these formal public hearings to discuss proposed freeway routings. Numerous conferences with city and county officials and their technical staffs were also held, as were several hundred preliminary informational meetings and map displays. The California Highway Commission itself also held seven public hearings during the year, four at the request of the local authorities and three on its own initiative. (The public hearings are listed in the statistical portion of the Annual Report.)

The California Highway Commission had under consideration during the year some 61 freeway projects and adopted routings on 49 of them. These adoptions increased the freeway mileage 348.3 miles, making a new state-

Engineers from the District 4 planning staff answer questions from interested citizens at a pre-public-hearing map display showing alternate routing studies in San Francisco.

wide total of 6,971 miles of declared freeway as of June 30, 1964.

Freeway Agreements

Close cooperation between the state and cities and counties resulted in working out and concluding 236 freeway agreements during the year. In some cases, original agreements were replaced by supplemental agreements which incorporated improved design standards or provided for changes in traffic patterns or local planning.

Interstate Highway System

Approval of the U.S. Bureau of Public Roads is required on the final locations of all routes on the interstate highway system. This is done for each interstate section after adoption by the California Highway Commission. At the end of the fiscal year, the locations for approximately 2,141 miles, representing over 98 percent of the interstate system in California, had been approved. This leaves only approximately 33 miles of interstate routing yet to be approved, nearly all of which is now under active consideration.

National Forest Highways

The Division of Highways acts jointly with the U.S. Bureau of Public Roads and the U.S. Forest Service in an annual improvement program on California roads designated as forest highway routes. The forest highway network in California covers approximately 2,580 miles, about 77 percent of which is on state highway routes.

The California apportionment of forest highway funds for the 1963–64 fiscal year was $4,726,004. The amount placed under contract or otherwise obligated during the year was $4,366,880, about three fourths of which was for projects on state highways. The unobligated balance is to be supplemented with 1964–65 fiscal year funds and allocated to a contract to be awarded early in the latter year.

The Bureau of Public Roads plans, designs, advertises and supervises the construction of federally financed forest highway projects. For projects on state highways, the Division of Highways works with the bureau in the planning and design phases and also obtains the required rights-of-way, including clearance of utilities and options on material sites.

Water Projects

It is a planning responsibility to determine whether the water development projects proposed by various federal, state and local agencies will affect state highways. Highway planning, due to such a project, may entail provision for anything from a simple distribution system crossing to the relocation of a substantial length of highway. It may also include the negotiation of an agreement with the sponsors of the water facility to apportion the cost of the work to be done among the parties concerned.

PHOTOGRAMMETRIC MAPPING AND AERIAL PHOTOGRAPHY

Aerial photography is used in advanced planning, design, right-of-way, and traffic studies, and also to some extent in other aspects of the highway program.

Photogrammetric mapping is frequently used during the advanced planning phase in conjunction with the study of possible alternate routes, and is used on most projects for the location and design of adopted routes. Most of this work has been obtained by contract, although part was done by the Photogrammetry Unit.

Total contracts completed during the fiscal year were:

	Contracts	*Highway strip miles*	*Contract amount*
Contour mapping projects for design	23	204.0	$229,111.00
Contour mapping projects for reconnaissance	3	37.6	62,768.00
Stereoplotter rental contracts	30		127,933.16
(Compilation for design)		222.1	
(Compilation for reconnaissance)		18.5	
Aerial photography contracts	9		21,908.00
Aerial photography contracts (blanket)	13		97,961.86
Total			$539,682.02

Another important activity is the taking of photogrammetric cross sections for particular construction projects. The cross-section data are automatically recorded on punch cards by means of an electronic attachment to

The Kelsh platter with Auto-trol digital scaler is used for taking terrain cross sections and recording directly on punch cards.

a stereoscopic plotting instrument. Six projects, a total of about 32.5 miles, have been completed this year.

Precision aerial photography of the terrain prior to construction provides a permanent and valuable record which can be referred to any time after construction has commenced. For this purpose it is necessary to premark or target the staked centerline, or its equivalent, before the photography is taken to insure positive identification of the line.

About two-thirds of the total mapping mileage obtained by contract is reviewed photogrammetrically. This service provides advanced information to the districts as a guide for performing accuracy test surveys by field methods.

Control Bridging

Photogrammetric control bridging is an operation aimed at the reduction of field survey effort, and provides a means of obtaining control data of sufficient accuracy for map compilation by direct-projection stereoscopic instruments. It is particularly applicable to remote, rugged, or otherwise difficult terrain which makes field surveys difficult to perform. Nine projects, mostly for reconnaissance mapping, have been completed this year.

Right-of-way Surveys

Photogrammetric determination of positions on the California Coordinate System are of sufficient accuracy for many right-of-way needs. Six relinquishment projects have been completed this year for District 4. In addition, on several projects for District 3 the positions of premarked property corners have been established in conjunction with photogrammetric control bridging.

Special Project

A contract between the U.S. Coast and Geodetic Survey and the Division of Highways was effected the previous fiscal year for a geodetic control survey of the San Diego metropolitan area. The purpose of the survey is to establish correct geodetic positions of the intersections of many state highways in this area; it is expected to alleviate confusion in future development of highway routings.

The fieldwork is being performed by state forces and is nearly complete. All computations and adjustments will be handled by the Coast and Geodetic Survey. Final position values are expected by January 1965.

PROGRAMS AND BUDGETS

Programs and budgets work includes coordinating the development of statewide long-range planning programs, preparing the annual state highway budget, scheduling and controlling the advertising of construction projects, maintaining a constant check on the present and future availability of funds, and administering the division's buildings and plants program.

Planning Programs

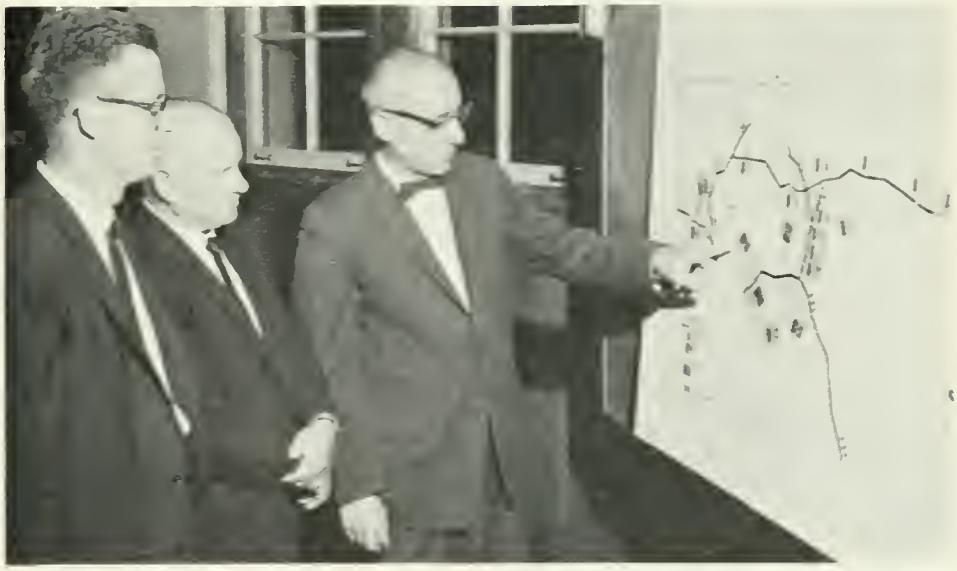
Planning program development is a continuing process which is formalized annually to reflect current data with respect to highway needs, availability of funds, and legislation.

The annual planning program is prepared by each district office for its area. These district programs are carefully reviewed by affected headquarters departments for conformity with established controls and continuity on a statewide basis.

The district programs, as adjusted and combined, become the formal statewide planning program and are then presented to the California Highway Commission for review.

State Highway Budget

The annual state highway budget is based on the planning program as a guide to project priorities. Many factors must be carefully analyzed to insure the most efficient use of funds.



Views of local groups and officials on project priorities are brought into the long-range highway planning picture each spring and summer through "on-the-scene" tours and meetings sponsored by the California State Chamber of Commerce. At a meeting in Martinez, Assistant Planning Engineer W. D. Bethell of the Division of Highways (left) and Norris Wiggins of the Contra Costa County Highway Advisory Committee take note as County Road Commissioner Victor W. Sauer points to a route map.

Estimates of revenue from both state and federal sources are made after consultation with other agencies involved.

After allowance for the operating needs of the division, the remaining funds estimated to be available are allocated to specific construction and right-of-way acquisition projects, in accordance with applicable legislative controls, to best serve the needs of

traffic and the overall economy of the state. The responsibility for final adoption of the final budget rests with the California Highway Commission.

The 1963–64 fiscal year budget included approximately $696,000,000 of which approximately $305,000,000, or 44 percent, represented federal aid apportionments. The budget included nearly $474,000,000 for construction and right-of-way acquisition, providing 279 miles of multilane freeway, 31 miles of multilane expressway, 26 miles of two-lane expressway, and 137 miles of conventional highway.

Advertising Schedules

Since California's highway program is operated on a pay-as-you-go basis, careful scheduling of expenditures is necessary to insure solvency of the State Highway Fund.

Revenue comes from two sources, state highway user taxes and fees and federal aid subventions. User taxes are received monthly and motor vehicle fees annually, and can be estimated rather accurately. Federal aid revenue is received on a reimbursement basis and is therefore dependent on the rate at which those projects which are financed in part with federal funds are placed under construction. Care must be exercised to maintain a balance between federal aid and regular state highway projects to insure that expenditures do not exceed revenues.

To maintain a steady flow of construction work throughout the state and thus make the most efficient use of both state and contractors' personnel, it is necessary to maintain a close liaison with the various district offices to coordinate the many functions necessary to eliminate delays in completion of plans, acquisition of right-of-way and clearance with other agencies.

Buildings and Plants

During the fiscal year construction was begun on the expansion of the District 11 Office Building in San Diego and the District 1 Office Building at Eureka. Construction of the new Shop 3 facility at Marysville, South Sacramento Maintenance Station, Elk Grove Maintenance Station, District 4 Materials Laboratory in San Francisco, and maintenance stations at Calistoga, Redwood City, Newhall, and Whittier was also undertaken.

Funds were provided for acquiring additional land for expansion of the District 7 Office Building at Los Angeles, parking facilities at the District 4 office, and the District 11 Office Building.

Plans were being developed and/or property was being acquired for new maintenance stations or additions at 19 locations throughout the state.

DESIGN

Preparation of contract plans for the construction of state highways requires determination of the geometric plan of the roadway and interchanges, the development of the roadbed structural design, the development of a plan to collect and dispose of drainage and a plan for erosion control and landscaping. In addition, special criteria and standards are applied to projects on the state scenic highway system. Roadside safety rest areas and other auxiliary facilities may also be included in the design of state highways. In addition, research and special studies are carried on continuously in all areas of highway design so that standards and concepts may be improved and techniques developed to reduce costs.

Four-quadrant cloverleaf interchange at the junction of two major freeways in the Santa Ana–Tustin area of Orange County. View is north along the recently opened Newport Freeway (Route 55), with the Santa Ana Freeway (Interstate 5) crossing over it.

With the exception of some of the roadside development plans the preparation of contract plans is performed by each of the 11 districts for projects within their separate jurisdiction. Headquarters Office aids the districts in establishing standards, furnishing advice, coordinate research projects, providing liaison with other agencies and maintaining uniform application of policy on a statewide basis. Preparation of some of the roadside development plans is done in Headquarters Office.

Geometric Design and Plan Preparation

Each interchange location or design situation presents individual circumstances, usually with some unique features. The development of an interchange plan requires considerable study and analysis of alternate plans in order that the freeway system may become an integral part of the total motor vehicle transportation system which will provide maximum traffic service, maximum safety, the least disruption of the community, and the least possible expenditure of tax funds.

During the past year geometric designs for 538 interchanges or channelized intersections were prepared. Contract plans were completed for 404 projects including 5,361 plan sheets.

Structural Design

The structural design of a roadbed includes a study of the availability and quality of roadbuilding materials in the area of the project, an analysis of the subdrainage and foundation treatment necessary, the determination of stable cut and fill slopes, an economic comparison of alternative pavement types and the preparation of specifications for the construction of the roadbed. The objective is to insure the most economical and effective use of available materials to meet the structural requirements.

The structural design portion of the *Planning Manual* has been revised and is now in effect. A major change is the modification of the procedure for determination of thicknesses of the various elements of flexible pavement sections based upon more recent experience and test track data.

Roadside Rests

The Design Department has been assigned responsibility for the planning and programing of the safety roadside rest system authorized by the 1963 Legislature. In this regard a tentative master plan for roadside rests has been established as a guide for financing and programing.

During the past year 21 project reports concerning roadside rests and geometric plans for 34 roadside rests along the interstate highway system were processed.

The current planning schedule proposes 30 rest areas for construction in the 1964–65 fiscal year. This makes a total of 46 rest areas presently completed, under construction or programed.

Scenic Highways

The Design Department during the past year has had the responsibility for the implementation of the scenic highway law passed by the 1963 Legislature. Work was undertaken on the preparation of a scenic highway planning and design booklet to establish basic criteria to be used in scenic highway design. This booklet was prepared with the advice and counsel of the Advisory Committee on a Master Plan for Scenic Highways.

In addition to the design booklet, instructions were issued regarding planning and design procedures to be followed in scenic highway development. Included in these procedures are field reviews by design personnel and the division's landscape architects in order that scenic features will be given special consideration in the design of the highway to provide maximum preservation of the existing scenery and advantageous presentation of this scenery to the road user.

Research and Special Studies

Efforts have continued toward obtaining the optimum use of modern innovations such as the electronic computer, photogrammetry instruments and new reproduction methods in order that engineering manpower may be conserved and more efficiently used.

Operational reports are prepared on each completed freeway project after it is opened to traffic in order that existing standards and concepts may be critically reviewed. Analysis of accident records and operational experience has led to the following developments in the past fiscal year:

1. New standards were developed which will provide more efficient traffic service at major freeway-to-freeway interchanges.
2. The standards for the basic width of medians on divided highways have been increased which, experience has shown, will provide a safer facility.
3. The steady uptrend in operating speed on California's freeways has led to the adoption of curvature and sight distance criteria which will be adequate for speeds up to 80 mph for rural freeways in lieu of the former 70 mph design speed.
4. To provide a greater margin of safety in view of the increasingly heavy traffic on major highways, shoulder widths were increased on freeways from 8 to 10 feet.
5. Experience with traffic operation on existing bridges has led to a modification of the criteria for determining which of the longer bridges should be provided with full shoulder width. As a result almost all new bridges which will be carrying traffic volumes approaching their capacity will be wide enough to accommodate emergency parking without blocking a traffic lane.

One of the illustrations in a recent manual of design standards for scenic highways, this photograph of US 101 at Ortega Hill east of Santa Barbara shows how turnouts may be provided for vista points at suitable locations.

Drainage and Cooperative Agreements

The investigation of new techniques for improved drainage practices is continuing. In cooperation with the Bridge Department, Materials and Research Department and Construction Department, the entire field of culvert installation practice is being reviewed. A new type of corrugated culvert is being introduced using a different corrugation, and the permissible height of cover is being investigated.

The number of cooperative agreements have increased largely because of the increased use of cooperative drainage projects with local agencies and also cooperative improvements of local road patterns. These changes are made in conjunction with the construction of freeways and have resulted in mutual benefits to the local agencies and the highway projects.

Erosion Control and Landscaping

Four roadside development units operating in Headquarters Office and three districts are responsible for the design and development of all planting projects. The Headquarters unit perpares landscape projects in all districts except 4 and 7 and functional and tree planting projects in all districts except 4, 7, and 8. Planting must be consistent with public safety and designed for ease of maintenance.

Typical cross sections for highway projects are reviewed by the roadside development unit for the purpose of recommending erosion control and preparatory landscape work. Certain preparatory items of work, where it is known that landscaping will follow construction, are more easily and more economically done during the road construction. These include contour grading, deep cultivation, topsoil-

The interchange of the Santa Ana and Long Beach Freeways in Los Angeles illustrates the dual role of low-maintenance shrubs and ground cover to control erosion on slopes and to complement bridge structures.

Good contour grading combined with simplicity in planting design provide effective landscaping at the interchange of the Nimitz Freeway (Route 17) with Route 92 near Hayward.

ing, paving small areas too confined for planting, and placing conduits and water lines under roadways for future irrigation systems.

Availability of plant material influences to some extent the design of planting projects. Many plants are purchased by the state from commercial nurseries while others are propagated and grown under contract between the state and a commercial grower. Some plants not generally popular for garden use, and therefore not available in quantity commercially, have proven adaptable for highway use. These are propagated at the state nursery near Davis. Whatever the method of procurement at least an approximate quantity determination is made well in advance of project preparation.

Representatives of the landscape section inspect roadside development projects under contract in order to assist resident engineers in the interpretation of plans and specifications.

Landscape personnel have also assisted in the review of safety roadside rest plans, with a view to increasing the value of the rest area to patrons by improving the aesthetic appearance of the general area as well as that of the individual units.

During the fiscal year 30 projects for landscaping, functional and tree planting were financed at an approximate total cost of $3,196,409.42. These projects involved the planting of approximately 118,729 trees and shrubs and 4,880,879 ground cover plants and cuttings.

TRAFFIC

Motor vehicle travel on the state highway system in 1963 was approximately 39 billion vehicle-miles, an increase of 7.3 percent over 1962. This was almost half (47 percent) of the total motor vehicle travel in California. Practically all of the increase was on freeways.

Urban areas accounted for more than half (57 percent) of the travel, although they comprise only one-eighth (13 percent) of the mileage. Freeways totaling 1,327 miles accounted for 17 billion vehicle-miles, or 43.5 percent of the travel on the 14,164-mile state highway system and 20.6 percent of the total motor vehicle travel throughout the state. There were 2⅓ billion freeway trips in 1963 averaging 7.3 miles in length.

Accidents

Average accident rates on the state highway system in 1963 were as follows:

	Total accidents per million vehicle-miles	*Fatalities per 100 million vehicle-miles*
Rural freeways	0.99	4.65
Rural expressways	1.77	7.40
Rural conventional	2.55	9.77
All rural highways	2.06	8.20
Urban freeways	1.57	2.38
Urban expressways	3.91	7.85
Urban conventional	5.44	4.03
All urban highways	3.03	3.14
All state highways	2.61	5.34

There were 101,801 accidents reported on the state highway system in 1963. This was approximately 3,000 more than in 1962. However, the amount of vehicle-miles traveled increased at a greater rate, which results in a slight decrease in the total accident rate. The number of accidents, amount of travel and accident rates in recent years are shown in the accompanying table.

The increased safety shown in the accident-travel rates table is attributable to the fact that almost all of the increase in travel on the state highway system occurred on freeways where the accident rate is less than half that of all other roads. If the amount of freeway travel in 1963 (3.44 billion vehicle-miles in rural areas and 13.52 billion vehicle-miles in urban areas) had been on conventional highways and expressways, on the basis of the higher accident rates, there would have been an additional 58,700 acci-

ACCIDENT-TRAVEL RATES

Year	Number of accidents	Travel (billion vehicle-miles)	Accident rate (accidents per million vehicle-miles)
1961	95,024	34.45	2.76
1962	98,292	36.36	2.70
1963	101,801	39.04	2.61

lents and 418 more fatalities. On the ame basis, it is estimated that the reeway system completed as of the nd of 1963 has saved more than 2,500 ives since 1949.

Research on Safety and Traffic

The following highway safety research projects were completed during he fiscal year ending June 30, 1964:

1. Analysis of fatal accidents on reeways in 1961 and 1962. *Highights:* One-half of all fatal accidents n freeways were single vehicles and nearly one-third (31 percent) were ingle vehicles which hit fixed objects. About one-third (30 percent) of all reeway fatal accidents were between 1 p.m. and 3 a.m.

2. The effectiveness of median barriers. Before and after studies indicate hat median barriers practically elimiate cross-median head-on accidents. Fatal accidents were reduced, but total ccidents and injury accidents increased.

3. Comparative freeway study (a tudy to determine why certain sections of freeway had accident rates ubstantially above or substantially beow the statewide average). In general, he higher accident sections were ound to have inferior alignment and older design standards.

4. Freeway pedestrian accidents rom 1958 through 1962. Contrary to previous belief, it was found that the hitchhikers are not the problem. About hree-quarters of freeway pedestrian accidents are disabled motorists and respassers crossing the freeways.

Other safety research projects underway were:

1. Evaluation of minor improvements. This is a continuing study to determine the effectiveness of minor improvements in reducing accidents and to establish or improve warrants for such projects.

2. Phase II of a study of wrongway driving on freeways. This study so far shows that the pavement arrows painted at all off-ramps have reduced the number of wrong-way entries at off-ramps.

3. A study to correlate ramp geometry to accident frequency.

4. A study to determine whether continuous highway illumination reduces nighttime accidents.

5. A study of accidents under conditions of reduced visibility to determine their cause and possible means of alerting drivers to the hazards.

Research continued on several phases of freeway operation. Studies of the effects of trucks on highway capacity and operation were stressed, and warrants for the use of climbing lanes should be available soon.

Considerable study was made of possible operational controls on freeways including ramp closures, and effects of these controls on the performance of both the freeway and city street network.

Other work included completion of a motion picture for training purposes which illustrates freeway operation as affected by various design features, and collection of data to be incorporated in the revised *Highway Capacity Manual* of the Bureau of Public Roads.

The *Traffic Manual of Instructions* was completely revised and will soon be distributed.

Traffic Counting

During the year a manual classified count of commercial vehicles (trucks and buses) was made to update the 1960 count. Traffic was not classified by number of axles in 1961 and 1962 because the mechanical counting methods in use since 1960 cannot differentiate vehicles by number of axles.

The 1963 classified count showed that the composition of commercial vehicles is substantially the same as in 1958 and 1960 except for a moderate increase in buses. The ratio of commercial vehicles to total traffic declined slightly, although commer-

A section of Interstate 5 in the City of San Diego, with steel cable barrier in the median.

cial vehicle travel increased 16.5 percent since 1960.

Traffic Signals and Illumination

Contract plans were completed for 142 new traffic signals and modernization of 182 existing signals. Contract plans were also completed for 3,577 lighting standards and 423 illuminated guide signs. The total estimated cost of the electrical work was $7,187,352, not including the cost of the steel sign structures.

A total of 156 traffic reports reviewing conditions at approximately 365 intersections were made to determine the need for traffic signals and lighting.

Research projects underway or completed include the following:

1. Completed installation of experimental pavement guidance lights to aid motorists to negotiate a curve on an expressway.

2. Completed development of the design for a fluorescent lighting fixture to be mounted in the fence rail on pedestrian overcrossing, thus eliminating the need for light poles on such structures.

3. Initiated development of a new lighting pole using fewer parts and providing a more pleasing appearance. This has been adopted as a standard for use on freeways.

4. Developed a new type electrical pullbox for use on the newer type structures to improve structure esthetics.

5. Continued studies of operation of the experimental emergency callbox system on freeways.

Traffic Regulation and Control

State highway routes have been renumbered and re-signed as required by state legislation enacted May 14, 1963. Some US routes have also been changed to the new interstate highway numbers or eliminated. All these changes were reported to the several auto clubs and map makers throughout the country so that their maps could be corrected prior to the tourist season.

Looking north along a recently opened section of Interstate 605 north of Whittier. Median barrier is supplemented by aluminum glare shield.

A white message on a green background was adopted as the standard color for state shields. All new shields being installed conform to this new standard. On the basis of a recently completed study, replacement of existing black-on-white route shields with the new white-on-green shields is being undertaken, and should be completed by the summer of 1965.

The program was well underway to eventually make all state highway signing comply with the 1961 *National Uniform Manual for Traffic Control Devices* as required by the Bureau of Public Roads for federal aid highways. Plans are being approved for contracts to be awarded in the 1964–65 fiscal year and priorities are being established for the orderly completion of the program by the 1968–69 fiscal year.

A revised sign chart was distributed in April 1964.

Speed Zones

As a result of the addition of Section 22356 to the Vehicle Code permitting the establishing of a 70-mile-per-hour speed limit on freeways upon the basis of traffic and engineering surveys, the maximum speed was increased to 70 mph on five sections of highway totaling about 120 miles. Other sections are being considered as they are completed to freeway status.

The reviewing and processing of traffic regulations initiated by cities, counties, and the districts involving parking, turning movements, and one-way operation of streets in the state highway system continued throughout the year. Two hundred such documents were processed.

Traffic Control Summary

Traffic control measures taken during the year included:

1. 184 restricted speed zones were established and 68 speed limit orders were rescinded, resulting in 252 additional miles of speed restriction on state highways.

2. 86,964 signs were approved for installation. A breakdown of this total shows 26,278 warning signs, 17,336 regulatory signs, 23,806 guide signs and 19544 miscellaneous and construction signs will be installed.

Until April 1, 1964, the Urban Planning Department operated in four general units: urban transportation, highway inventories and legislative reports, research and special studies, and electronic data processing. On April 1, transition of the electronic data processing section into full department status was begun, the new Computer Systems Department becoming one of the administrative functions of the division.

In cooperation with the administrative departments, the library, which serves the entire Division of Highways, embarked on an expansion of activities to provide a coordinated library service. Initial steps included an inventory and limited indexing of reference material which can be made available on loan from one department to any other department of the division.

City and county officials comprising the advisory committee for the local road and street needs study (Section 2156) meet with Division of Highways staff members. At head of table are E. A. Fairbairn, city manager of Sacramento, committee chairman (right); and A. S. Koch, road commissioner of Orange County, committee secretary.

Legislative Reports

Senate Concurrent Resolution 23 of 1963 requested a feasibility study of a controlled-access highway between San Simeon and Monterey. SCR 26 (1963) requested a feasibility study of a highway from the Westside Freeway to Turlock and Merced. These studies were completed for the Legislature.

Other legislative resolutions requested consideration of proposed state highways at various locations. The need for such other state highway routes is being considered during the review of the entire state highway system, which was started during the year as provided in Section 256 of the Streets and Highways Code. Liaison was maintained with the League of California Cities and the County Supervisors Association in this study. Each county and city was contacted and invited to suggest changes in the state highway system in addition to those being considered by the Division of Highways. At the close of the year this study was still underway.

Chapter 385 of the 1963 Statutes (Senate Bill 64) renumbered the state highway system of California effective July 1, 1964. Various instructions, maps, tables, cross indexes, etc., were prepared to assist in the changeover to the new numbering system. Concurrently state highway routes were placed on a post-mile basis and alphabetic sections were abolished. Post-mile maps, tabulations, and cross indexes were prepared and distributed to aid in this change.

In cooperation with the districts, preliminary work was completed for the State Highway Needs Study (Section 188.8 of the Streets and Highways Code).

The first quadrennial California city street and county road progress and needs report was undertaken as called for by Section 2156 of the Streets and Highways Code. With the help of the advisory committee and others, street and road standards relating traffic to geometric design were drawn up to guide the 11 state highway districts, 384 cities, and 58 counties, in the conduct of the study. Estimates of needs and progress were received from all cities and counties in the state. At the close of the year, work of final audit and preparation of the required report to the Legislature was underway.

Federal Projects

Coordination and assembly of the work of the districts and several headquarters departments in the preparation of the estimate of cost to complete the interstate system for California was almost completed by the end of the fiscal year.

Monthly reports on the status of completion and development of the interstate system were prepared for the Bureau of Public Roads.

Urban area maps of all 267 urban places were completed and distributed to the districts during the year. Federal aid primary system strip maps were prepared. Federal aid secondary system strip maps were still underway at the close of the year. A state map showing the interstate and primary systems and the renumbered state highways was updated and distributed.

Urban Transportation Planning

An important segment of urban planning activity in the past year has been directed toward the qualification of the state's 11 urbanized areas under the requirements of the 1962 Federal Aid Highway Act relating to comprehensive transportation planning processes. Written memorandums of agreement with local governments, supported by a narrative of the planning process and past accomplishments, have resulted in qualification of the Fresno and San Diego areas by the Bureau of Public Roads. Executed agreements have been obtained in two other areas but require narrative development before submission for approval; negotiation of agreements and documentation are underway in the remaining areas.

A coordination process for highway planning studies financed by the Bureau of Public Roads funds and local planning studies financed by U.S. Housing and Home Finance Agency grants was established in cooperation with the State Office of Planning, which administers the HHFA funds.

Metropolitan Transportation Studies

The Los Angeles Regional Trans-Study (LARTS) published a base year report in February 1964. The report described the 1960 data collection surveys including the land use survey, the O&D home interview, and the external trip survey. The models developed by the study for estimating trip generation and for obtaining traffic profiles were also described.

In the latter part of the fiscal year, work was continued on the 1980 input information for the LARTS model.

The data collection phase of the Eureka Area Planning and Transportation Study was completed in October 1963. The basic data, after expansion, have been furnished to the City of Eureka and Humboldt County. These data, together with other information obtained during the study, will be utilized for long-range planning and route location purposes.

Field operations for a similar study in the Santa Barbara area called "South Coast Transportation Study (SCOTS)" were begun April 1, 1964.

Looking west along the Santa Monica Freeway (Interstate 10) in Los Angeles, shortly before the freeway was completed westward to La Cienega Boulevard in November, 1964. Barricades in photo, now removed, indicated previous temporary end of freeway at Vermont Avenue interchange.

Looking northerly from the Calaveras River Overcrossing toward the Hammer Lane Overcrossing and Lodi on the new freeway between Stockton and Lodi.

Statistical and Nonmetropolitan Studies

Extensive use was made by the districts of the machine processing services provided for economic and traffic analyses of alternative freeway locations and major street networks. During the year a total of 805 hours of 704 computer time were required for the processing of 36 urban route location studies involving 87 alternates. To further encourage and facilitate the use of these services an instructional booklet entitled, "Urban Area Freeway and Major Street Network Traffic Analysis," was prepared and distributed to district offices.

Field operations for the 1963 Loadometer (Truck Weight) Survey produced axle weights, trip characteristics, and commodity data for 18,420 trucks at 25 locations throughout the state.

The Road Life and Pavement Cost Study was continued for the 12,200 miles under study with 60 percent recorded to 1962 and the remainder to 1959.

Research and Special Studies

Coordination of all research and special studies conducted or participated in by the division was continued. Research funds were received from federal aid 1½-percent planning and research funds, state highway user taxes, Chapter 2110 of the 1961 Statutes, Item 357 of the 1963 Budget Act, and Item 321 of the 1964 Budget Act. A five-year highway safety research planning program was developed, which totaled $1,330,740, using some funds from all these sources.

Close liaison with the Transportation Agency Research Council, as well as participation in its Staff Research Committee, was maintained. Formal review and encouragement of research activities within the Division of Highways were begun under the direction of a newly formed Research and Special Studies Committee. Recommendations were made seeking a balanced program in traffic, safety, physical, economic, and behavioral highway research.

The State Highway Inventory data sheets were continually updated as new data became available from project reports, planning studies, planning programs, and district review. The capacity adequacy rating procedure was refined and completed for the entire constructed state highway system.

Special maps and exhibits of a general planning nature were prepared for other departments as requested. Special maps were also prepared as requested by members of the Legislature and other state agencies.

Bridges

- *The Bridge Department is under the administration of the Assistant State Highway Engineer—Bridges and is responsible for the design, construction and maintenance of all bridges and structures on the state highway system*

A branch office of the Bridge Department is located in Los Angeles to maintain liaison with southern area districts, perform planning functions and supervise construction and maintenance of structures within these districts. All other functions, including design work, are handled at headquarters in Sacramento.

The department is divided into five sections—planning, operations, special studies, office engineering, and special projects.

BRIDGE PLANNING

Advance Planning

During the past fiscal year the Bridge Department continued its work of investigating bridge sites, preparing preliminary reports for bridge design, producing architectural sketches and models of bridges and interchanges, assuming responsibility for the aesthetic treatment of structures and maintaining close liaison with headquarters and the districts throughout the project planning and design stages.

There was a trend toward larger and more complicated, though fewer, structures than the previous year. Engineering design was started on 508 structures.

During this period an unusual number of viaducts and tunnels were studied. Possible use of viaduct construction was studied for sites in San Diego, Los Angeles, Santa Barbara, Stockton, San Francisco, and Sacramento. Studies were completed for depressed roadway structures, cantilevered highways, and numerous large tunnels, both cut-and-cover and bored, in connection with route studies in San Francisco.

The Bridge Department worked closely with the districts, local interested groups, architects, architectural consultants and the Design Department in endeavoring to improve the appearance of structures generally, with particular emphasis on major structures and structures on the scenic highway system.

Continued emphasis on aesthetics in bridge design was also evident in work on scale models and sketches.

Sixteen models, including four models showing substantial portions of the Sacramento freeway system, were constructed and placed on public display. More than 180 architectural sketches and retouched photographs were completed also to assist the public, in a visual way, in understanding the plans of the department.

Faundation Section

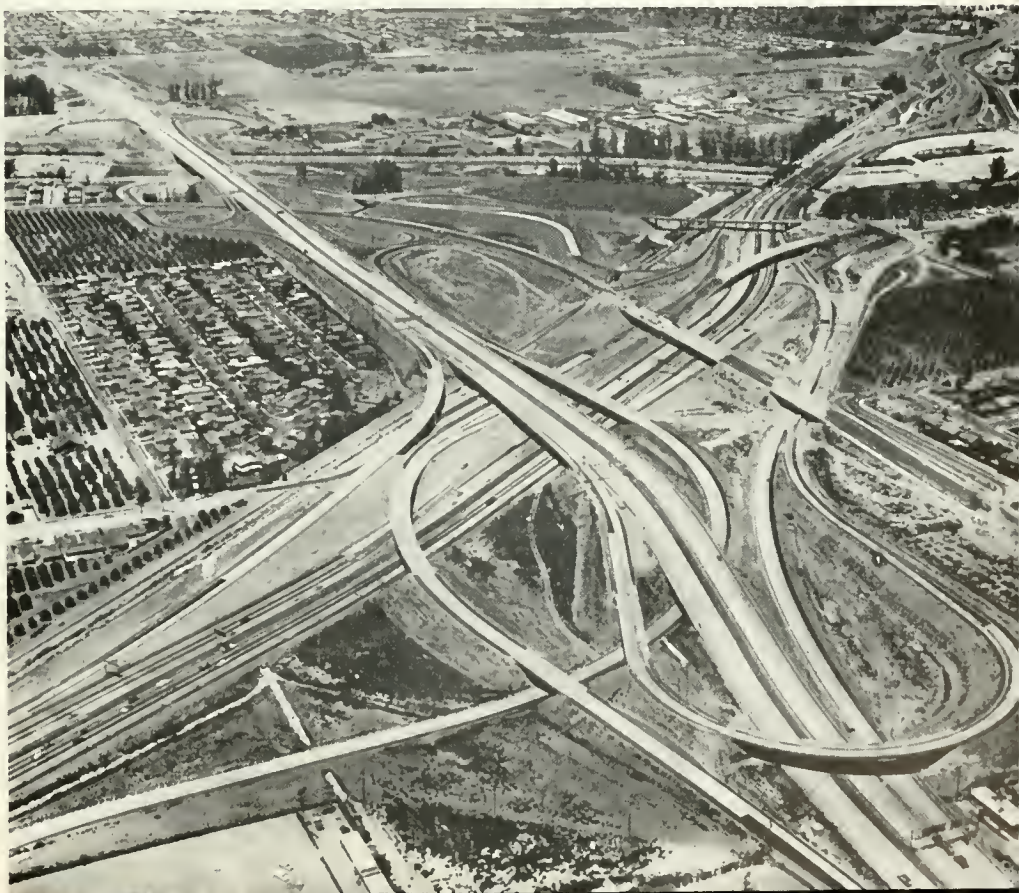
A total of 475 foundation studies for bridge, freeway and retaining wall structures were completed. A total of 121,126 lineal feet of exploratory borings were drilled during the year to determine foundation conditions at various sites.

One of the foundation highlights of the year was the successful installation of the six-foot-diameter "cast in drilled hole" piles for the Fort Sutter Viaduct in Sacramento which is presently under construction. The second contract for the Fort Sutter Viaduct (Unit No. 2) will utilize six-foot-diameter piles belled out to 12-foot diameter at the bottom. This will be the first major freeway structure in California utilizing this type of foundation.

Design

Spectacular bridge design projects were rather rare in 1963–64.

Looking west along the Garden Grove Freeway at the interchange which carries it over the Santa Ana Freeway.



In the south the bridge on Interstate Route 40 across the Colorado River at Topock is now under construction. This is a $2,400,000 job, of which Arizona pays half. This is the third state highway bridge in this location. The original highway bridge is now used to carry a high-pressure gasline which runs from Texas into California. The second bridge was built by the Santa Fe Railway and was remodeled for highway use after the Santa Fe built a new and heavier bridge.

Some important projects were completed in San Francisco. The largest is the $7,500,000 third unit of the Route 82 Freeway. A $4,000,000 project consisting of 13 bridges, including a three-level interchange, was completed on Interstate Route 280 at the San Francisco-San Mateo county line.

Plans were completed for a new bridge across the Sacramento River in the vicinity of W-X Street in Sacramento. This $15,000,000 structure is now under construction. The bridge is the first link in the construction of the East-West Freeway through Sacramento on Interstate Route 80. The main river spans of the bridge are 275 feet in length with a vertical clearance of 55 feet above flood plain.

Plans were started for approximately 30 bridges and grade separations for Interstate Route 880—a new route skirting the northern limits of Sacramento. Included in this project is a bridge across the Sacramento River at Bryte Bend.

During the past year a design was made for the new bridge across the Klamath River at Klamath. This $1,500,000 structure will be on new and improved alignment of US 101.

The existing historic Klamath River Bridge, built in 1924 will remain to serve local traffic. Continuing the 40-year tradition of the existing bridge, the new structure will have two large golden bears guarding each entrance.

Bridge Construction Costs

Bridge construction costs are measured by the Bridge Department Construction Cost Index, which utilizes the cost data of the years 1939 and 1940 as a base equal to 100. During the fiscal year 1963–64, the corresponding indexes for the four successive quarters were 275, 274, 264, and 272. The general level of costs represented by the foregoing indexes is about equal to the average level of construction costs of the past three years, which was within the range of 270 to 275.

BRIDGE OPERATIONS

Sixty-nine structures in 41 Bridge Department - administered contracts were completed during the year at a total dollar value of $30,826,201. This included the Vincent Thomas Bridge superstructure (the third largest suspension bridge in California) for approximately $11,000,000 and the Randolph Collier Tunnel for $4,400,000.

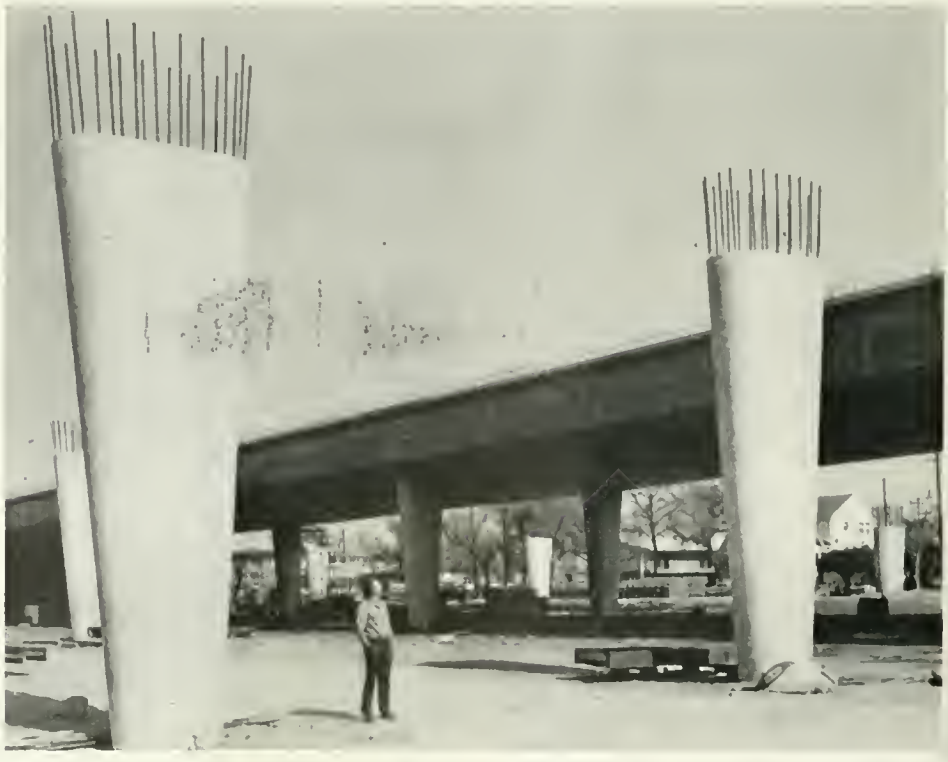
There were completed during the year 375 structures in 80 district-administered contracts, with the structures having a dollar value of $55,649,663. A number of retaining walls were constructed, bridges widened, and existing structures repaired.

Structure work having an estimated cost of $163,000,000 is included in 179 projects underway at the end of the fiscal year. These included the Caldecott Tunnel contract, projects financed from various fiscal year budgets, and work on federal aid secondary projects.

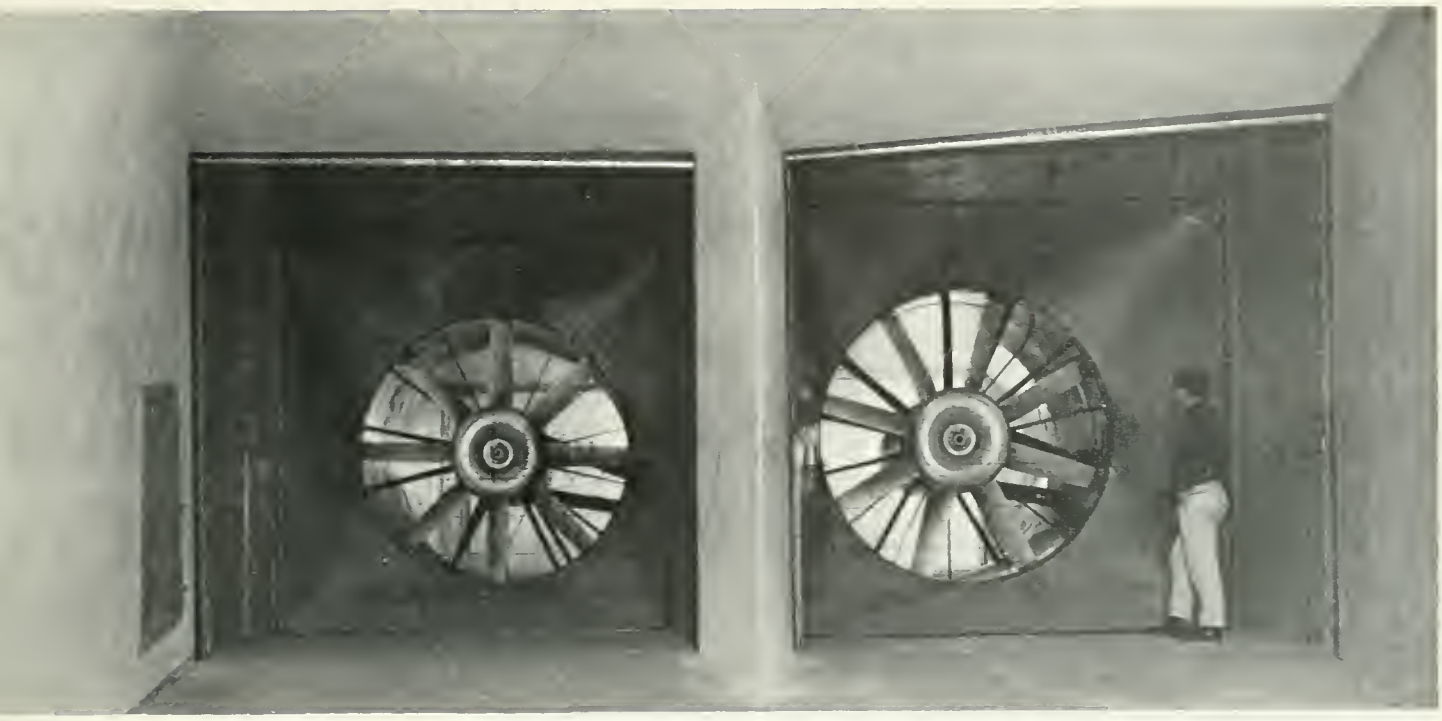
The 1963–64 state highway budget had $77,042,000 in structure work in 116 projects. Miscellaneous contracts, including maintenance, FAS, and work for other agencies, amounted to $5,341,000 structure work in 27 projects. The grand total of all structures in this budget year that were advertised and placed under contract was $82,383,000.

Metropolitan Area Freeway Structures

In the San Francisco Bay area, the Southern Freeway in San Francisco was completed from its west end to the Mission Street Overcrossing and from Newcomb Avenue to Army Street. A half-mile double-deck viaduct section extending northeast from



Now under construction is the Fort Sutter Viaduct between 29th and 30th Streets in Sacramento, which will carry traffic on Interstate 80. Tapered piers and sloping sides of girders are used to enhance the appearance of the structure.



These ventilation fans will supply fresh air to the new bore of the Caldecott Tunnels between Oakland and Orinda on Route 24.

he Bayshore Freeway was completed n February 1964. A $5,000,000 con-ract to construct a section of the via-luct for the freeway from the section of the double-deck viaduct completed n February to Army Street is under-way, as is a two-mile section of free-way extending south from the South-ern Freeway, having 13 structures.

In Alameda County, a troublesome ntersection was eliminated on Warren Boulevard with the completion of the Moraga Interchange. This intricate three-level interchange includes three oridges plus extensive retaining walls. The extension of the Route 680 Free-way down the San Ramon Valley into Alameda County will include nine oridges. The interchange between Routes 580 and 680 on the project will feature a variety of steel super-structure designs, including four or-thotropic spans.

In Contra Costa County two major projects are of interest on Route 680. One, through Concord between Mon-ument Boulevard and Olivera Road, includes seven bridges. One of these bridges is of unusual design in that the superstructure contains a long three-span segment of continuously prestressed concrete box girder. The spans are 160, 214, and 160 feet, and the steel stressing tendons are threaded through the open cells of the deck.

Bridge work on the second project includes 13 bridges. This unit extends from Danville to Walnut Creek.

In the Los Angeles, San Bernardino and San Diego areas, a total of 194 structures were completed and 323 additional structures were under construction at the end of the fiscal year.

Major construction activity centered on the Santa Monica Freeway and the San Gabriel River Freeway in the Los Angeles area. Eight structures were completed and the final 49 structures are under construction on the Santa Monica Freeway. Ten structures were completed and 50 are under construction on the San Gabriel River Freeway between the San Diego Freeway and the San Bernardino Freeway.

An additional 10 structures were completed on the San Diego Freeway and 29 are under construction in the Long Beach-Santa Ana area. In this same area 5 structures were completed and 28 are under construction on the Garden Grove Freeway.

Work continued on the Ventura Freeway with 14 structures completed and 11 under construction.

The Pomona Freeway was started and now has 13 structures under construction.

Two notable projects were the construction of the interchange between the San Diego Freeway and the Santa Monica Freeway in the Los Angeles area and the interchange between the Santa Ana Freeway and the Garden Grove Freeway in the Santa Ana area.

The Route 15 Freeway between San Bernardino and the Nevada state line southwest of Las Vegas was placed one step nearer completion with the awarding of the last contract, including 19 structures between Cronese Valley and Baker. Twenty-seven structures were completed and 27 are under construction on this highway.

Progress is continuing in the San Diego area on the Route 5 Freeway with 29 structures completed and 13 under construction. A total of 53 structures were completed in the San Diego area and 51 are under construction.

In the Sacramento metropolitan area work is in progress on the first of two contracts on 29th and 30th Streets, which will connect the previously constructed South Sacramento and Elvas Freeways on Routes 99 and In-

The new concrete bridge across Raymond Meadow Creek on Route 4 in the rugged terrain of Alpine County.

The 700 foot steel arch span across Cold Springs Canyon on Route 154 between Santa Barbara and Santa Ynez.

terstate 80. Work on the second contract started during the latter part of 1964.

The substructure work for the Sacramento River Bridge at W and X Streets, consisting of three river piers was completed in September of 1964. Construction of the remainder of this structure, which will extend from Jefferson Boulevard in West Sacramento to Fifth Street in Sacramento, on Interstate Route 80, started during the latter part of 1964.

Other Major Projects

Work was completed on the last stage of the bridge and fill crossing of the Yolo Bypass. The structures were opened to divided traffic on October 25, 1963.

The steel arch bridge spanning Cold Spring Canyon on new Route 154 in Santa Barbara County was completed December 24, 1963, and opened to traffic soon afterward with the completion of an adjacent road contract.

At the completion of the Webster Street Tube, the Posey Tube was closed for a renovation contract. The renovated tube in turn was opened to traffic November 21, 1963, and divided traffic began flowing between Alameda and Oakland. The renovation contract was completed January 30, 1964, for approximately $1,200,000.

The new 3,300-foot-long Caldecott Tunnel through the Berkeley Hills was within a few days of completion at the end of the fiscal year (June 30, 1964). The project is parallel and adjacent to the two existing bores, which are scheduled for renovation following opening of the new tunnel to traffic.

The tunnel, including two portal buildings and operating system, roadwork, and exterior bridges and retaining walls, will cost nearly $11,050,000. The project was awarded on November 25, 1960.

The tunnel bore is 3,300 feet long with a pavement width of 28 feet between curbs and a vertical clearance of 17 feet to ceiling slab. The inside dimensions to the arch tunnel lining are 34′ 6″ horizontally and 33′ 9″ vertically. The tunnel walls and ceiling are lined with tile and illuminated with the latest fluorescent lighting system. Included in the tunnel operat-

This new bridge across the Cosumnes River near Sloughhouse in Sacramento County was built with federal aid secondary funds, replacing an old steel truss span built in 1906.

ing system is an electrical power system, ventilating system, plumbing system, fire alarm and firefighting equipment, closed circuit television system to maintain traffic flow, emergency telephone, public address and intercommunication systems.

City and County Bridges

During the year, the city and county bridge projects engineer reviewed plans and specifications for bridges and minor structures in 60 projects under the modified gas tax financing provided by the Collier-Unruh Local Transportation Development Act.

In addition, 13 federal aid secondary bridges with an estimated cost of $1,400,000 were in the final planning stage and 29 bridges in 19 FAS contracts with a contract structure cost of $3,200,000 were completed or under construction. The county engineering departments prepared the plans for 26 of the latter structures and provided the construction engineering for 19.

Bridge Maintenance

The bridge maintenance section continued the periodic field investigation of the 7,762 bridges on the state highway system. Reports and plans were developed for needed repairs and minor improvements, the review and updating of capacity ratings, and scheduling of replacement of structurally critical bridges as necessary.

During December 1963 a critical problem developed on the bridge over the Bear River on Route 65 between Roseville and Marysville. The continuous T-beam structure was constructed in 1915 and suffered scour and foundation settlement in recent years. A transverse failure required closing the bridge to all traffic. While traffic was detoured over local roads, state forces formed and poured concrete to replace the defective deck and strengthen the girders. In the spring of 1964 a contract was awarded to construct a new bridge downstream to replace the old bridge.

On December 18, 1963, the Danish ship MV *Pasadena*, a freighter traveling upstream, struck and damaged a span of the San Joaquin River Bridge (Antioch) on Route 84. The lift span of the structure was open, but the ship was off course passing through a fixed span. Several stringers were severely damaged, flanges of the main members were nicked and kinked and a section of concrete floor in one panel was knocked out. The members were heat-straightened or replaced by state forces.

The bridge maintenance section made engineering investigations at the request of local authorities for 122 city and county bridges to establish their load-carrying capacity. Thirteen public hearings were held to consider speed and load postings for these bridges.

Bridge Maintenance Painting

During the past fiscal year, four maintenance painting contracts involving eight structural steel bridges were initiated by the Bridge Department. The steel surface area of these bridges is about 325,000 square feet which represents less than 2 percent of the total steel surface area on bridges in the state highway system. The low percentage of bridge steel requiring repainting indicates the superior quality of protective coatings applied during the past decade.

Much of the success in extending paint service life has been made possible through an experimental program. Twenty-seven separate panels are now hanging on bridges near the seacoast for destructive testing of different paint coatings.

SPECIAL STUDIES

The aim of the bridge special studies section is to find and make available the means of providing improved economy, usefulness and safety of highway structures through research and development. Its raw materials are the new, untried or incompletely understood structural system or detail, construction material or method, engineering procedure or tool. Its products are related facts, observations, recommendations and implementing services or procedures.

During the past year, some of these products have taken the form of reports on the use of high strength steel in bridge bearings; the behavior of epoxy bonded aggregates as shear connections in composite concrete-steel girders; the performance of bituminous surfacing at bridge deck expansion joints; and the deflection characteristics of a major steel arch bridge.

Climaxing several years of effort jointly with the University of California and the Materials and Research Department, the final manuscript of a report on the box girder research project has been submitted to the Highway Research Board for publication. It describes extensive testing and investigation of a reinforced concrete bridge superstructure system whose elemental shape is a rectangular box. The work involved observation of behavior under controlled loads by means of electronic devices embedded in both a full-scale bridge and a quarter-scale laboratory model of the same bridge.

Approval has been obtained to proceed with a study of similar scope on another superstructure system, this time of orthotropic configuration in steel. Its appearance in crosssection can be compared to the cellular structure of a layer of dividers in a common egg crate. It, too, will involve construction of a bridge which is instrumented to make possible the subsequent collection and analysis of performance data. A pilot effort on this subject has already advanced beyond the data collection stage, using a limited segment of a bridge that is now open to traffic.

Other subjects currently under study include culvert behavior under a high earth fill; vehicular tunnel ventilation; and loss of prestressing force due to friction along the tendons of a prestressed concrete girder.

A library, which furnishes information on technical subjects, and a hydraulics unit, which provides information and analyses on bridge waterway and bank protection problems, are other services of the section. A computer services unit develops electronic data processing services to perform engineering and administrative tasks and maintains them after they become usable.

Emphasis this past year in E.D.P. work has been on extension and refinement of structural engineering services. Programming efforts on substructure frame, concrete column, composite girder, prestressed girder, influence line, and slope stability problems were substantially completed, though some have not yet been published for use.

Bridges on the State Highway System Segregated as to Number, Length and Area by Structure Type, as of June 30, 1964

Structure type	*Number* 1964	*Number* 1963	*Length* [a] *(feet)* 1964	*Area* [b] *(square feet)* 1964
Concrete arch	229	232	36,609	841,104
Concrete girder	2,361	2,158	542,370	34,887,189
Concrete slab	2,483	2,414	151,549	6,543,693
Masonry arch	32	33	945	21,735
Subtotal concrete and masonry	5,105	4,837	731,473	42,293,721
Steel arch	6	5	2,618	42,655
Steel plate girder	374	358	182,983	8,056,799
Steel stringer	274	277	58,739	3,671,297
Steel deck truss	30	30	33,166	1,550,439
Steel pony truss	29	29	10,524	168,548
Steel through truss	62	63	115,814	1,485,801
Suspension	3	2	21,159	1,014,821
CMP multiplate and arch	76	77	1,467	49,243
Subtotal steel	854	841	426,470	16,039,603
Timber arch	1	1	59	780
Timber stringer	538	585	39,575	1,405,646
Timber deck truss	5	6	1,156	20,782
Timber pony truss	0	0	0	0
Timber through truss	0	1	0	0
Subtotal timber	539	593	40,790	14,278,208
TOTAL BRIDGES	6,498	6,271	1,198,733 (227 miles)	72,611,532 (1,667 acres)
Underpasses	183	181		
Overheads *	292	266		
Combined bridge and overheads *	56	54		
State highway separations *	323	294		
Road undercrossings *	1,292	1,179		
Road overcrossings	934	813		
Pedestrian undercrossings *	182	176		
Pedestrian overcrossings	99	86		
Cattlepasses *	90	90		
Tunnels	22	21	22,247	
Retaining walls	6	6	4,707	
Miscellaneous	20	20	400	10,325
TOTAL STRUCTURES	7,762	7,398	1,226,087	72,621,857
Drainage pumping plants	206	193		
Railroad grade crossings	629	641		

* Separations so noted are listed under structure type above.

NOTE: One underpass, 23 overheads, 1 tunnel, and 4 bridge and overheads also serve as state highway separations.

[a] Structures of assorted types and lengths of spans are by number and length of main span.

[b] Areas are based upon clear width of roadway between curbs and clear sidewalk width.

BRIDGE OFFICE ENGINEERING

Bridge office engineering includes the administration and management of the various service units.

A major function is the negotiation and preparation of maintenance and construction agreements with railroads in connection with construction of railroad grade crossings and grade separations.

Railroad Grade Crossings

Construction was started, underway or completed on 46 highway projects requiring negotiations with railroads which involved right-of-way encroachments, installation of additional crossing protection, construction, alteration or abandonment of grade crossings. At the end of the fiscal year, negotiations with the railroads were in progress for 31 additional highway projects on which construction had not yet started. In addition, 17 projects involving improvement of existing crossing protection were completed or underway.

On federal aid secondary routes, negotiations were underway or completed on 14 projects with railroad involvement.

Railroad Grade Separation Structures

At the beginning of the fiscal year, 71 railroad-highway grade separation structures were under construction. A total of 43 separation structures were placed under contract during the year of which 8 were underpasses and 35 were overhead structures. During the year, a total of 54 separation structures were completed. The railroads are contributing an estimated $748,455 towards the cost of constructing 11 of the 54 completed structures.

Two state highway bridges won awards of merit from the Prestressed Concrete Institute in 1964, as illustrated in this photo of a display in the Public Works Building in Sacramento. The Willow Creek Bridge is on Route 1 on the Monterey County coast; the prestressed carrying beams support the concrete and steel spans which carry freeway ramps and other structures over the Arroyo Seco Channel in Los Angeles.

$5 Million Grade Crossing Fund

The California Public Utilities Commission issued its 1963 Priority List containing 26 proposed projects, to eliminate existing railroad grade crossings by structures or reconstruct existing separation structures, on county roads and city streets. In accordance with state law, $5,000,000 in state highway funds are set aside by the Highway Commission each year to pay half the cost of these projects after deducting the railroad's contribution.

As of June 30, 1964, allocations totaling $4,471,093.89 had been made by the Highway Commission from the 1963–64 fiscal year fund for 8 of the 26 projects on the PUC priority list.

SPECIAL PROJECTS

The Vincent Thomas Toll Bridge between San Pedro and Terminal Island in the Los Angeles Harbor area was opened to traffic on November 15, 1963. Some painting of the structural steel remained to be done at the time of opening and this was completed and the superstructure contract for the project was accepted on April 28, 1964.

The Carquinez Strait Bridge revenue bonds were refinanced as authorized by the California Toll Bridge Authority to provide funds for reconstructing the Solano County approach to the Benicia-Martinez Bridge. A contract in the amount of $8,875,000 was awarded on May 13, 1964, for this approach work which extends 12 miles, from the toll plaza at the north end of the Benicia-Martinez Bridge to IS 80 at Cordelia.

Personnel & Information

The functions of personnel, training, safety, audio-visual services and public information are grouped administratively under the direction of the engineer in charge of personnel and public information

PERSONNEL

Recruitment

Two hundred sixty-nine engineer graduates were hired this year as the result of recruitment at engineering colleges throughout the country.

In a highly competitive engineer recruitment situation, California colleges are not able to provide sufficient numbers of qualified engineers to meet the demands of employers. Consequently, an assertive recruitment plan began in 1957, including the sending of recruiters to engineering colleges in all regions of the country with the authority to make employment offers to promising graduates. Other state agencies participate in this program, which is coordinated by the State Personnel Board.

The result of this effort has paid off by placement of 1,782 engineer graduates from nearly 100 colleges since 1957. These men have brought to our organization a new breadth of background and fresh approaches. We are looking forward to continued efforts in this direction.

Personnel Management

The result of another plan initiated in 1957 deserves comment. The division has a large reservoir of able manpower with extensive experience in engineering, but without completed formal college training. These men fill essential roles in the division's engineering services, yet their advancement was often stymied by competing directly with professional engineers in promotional examinations.

This situation was resolved by the introduction of a separate engineer series of "technicians" which parallels the professional classes through the associate engineer level. This has resulted in improved use of manpower through increased promotional opportunities to positions of responsibility, and the recognition of the complementary nature of professional and technical backgrounds on various projects.

The development of supervisory, management, and administrative staff personnel for future years is a continuing effort. Currently, age profiles are being worked out to enable management to determine future needs in this area. The Right of Way Department continues to make extensive use of employee development appraisal techniques to insure the spotting of potential talent in making promotions.

New Series

A new classification series was introduced last year known as highways administrative officer. This step is intended to focus the supervision of nonengineering services in the hands of administrative staff personnel through a class series of increasingly responsible levels. The new series should provide a broader range of staff activities under nonengineering personnel than has existed in the past and more opportunity for employee development in this area.

A new program is being put into effect which offers full apprenticeship training for highway equipment mechanics. This is being done with the help of the Division of Apprenticeship Standards.

The new Division of Highways accounting and reporting system required comprehensive and detailed development for accounting personnel throughout the state. Training included a five-day developmental program including coding, form usage and preparation, accounting and control procedures and accounting and management reports. Here Oliver Pool, District 7 Maintenance (standing left), E. J. Wintermute, Headquarters Training, John Gliebe, Fiscal Management and Ken Hammon, District 3 Accounting, teach a class in District 10 (Stockton). *(See "Fiscal Management," page 68.)*

Alterations were made in the landscape maintenance classifications so that landscape maintenance crews could be brought under the direction of highway maintenance superintendents. The purpose was to provide closer coordination in the maintenance of the highway and its adjacent landscaping.

Changes in the division's accounting system eliminated the need for bookkeeping machines and the 33 operators who manned these machines throughout the state. As most of these operators have had more than a decade of experience with the division, every effort was made to retain them through retraining in new assignments. All of these employees have been placed and changes in classification are being completed.

In connection with the Governor's program for equal employment opportunities, an ethnic census of division employees was conducted. Efforts to implement the division's longstanding policy of nondiscrimination are continuing through review of recruitment and promotion procedures.

Statistics

On July 1, 1964, there were 16,758 employees on the Division of Highways' staff, an increase of 472 over the previous year. The staff includes 8,872 engineering employees, 592 right-of-way employees, 413 equipment repair employees, 3,878 maintenance employees, and 3,030 clerical and administrative staff personnel. During the fiscal year, 1,633 promotions were made.

During the current year, 19 employees were dismissed—10 from permanent positions. Twenty-six were rejected during probation, none were demoted, and 43 were suspended. A total of 190 employees retired. Fifty 25-year awards were given, making a total of 2,271 for the division.

During the year, 192 visitors from 35 countries were guests of the division, generally under the auspices of federal government programs. Discussions and training programs, varying from a few hours to several months, were arranged for each individual.

TRAINING

The name of training activities used by the Division of Highways include planned individual development, formal division training courses, and workshops, interagency programs, on-the-job training, and short courses at colleges and/or universities.

Formal training courses were given in almost every job-related subject and in orientation, management and supervision, professional and technical, engineering, right-of-way, maintenance, and clerical, among others. These courses took 312,855 hours, an average of 24.36 hours per employee.

Supervision and Management

Formal training of supervisors used 46,935 man-hours, or 15 percent of the total training time.

The major management training effort during the fiscal year was the installation of a new "management reporting system." This system is designed to provide each supervisor, on a monthly basis, accurate and up-to-date summary information on the cost, projects, and types of work performed in his portion of the organization.

The regular "management and supervisory" course was given to supervisors in engineering, right-of-way, and staff functions, who had not participated in the 40-hour course before. This is a continuing program which soon will have reached all current supervisors and will be given to new supervisors as they are appointed. It is a part of an overall management development curriculum, which includes formal training and development activities for all levels of management.

Top level managers participated in the interagency management development program. Examples of courses and workshops attended are the "Governor's Annual Management Conference," "Regional Management Conferences," "Data Processing for Managers," "Legislative Processes," "School of Management" and "Public Administration."

A 16-hour critical path method seminar, taught by representatives of the Bureau of Public Roads, was given to 62 engineers and administrative staff personnel.

Technical and Professional

A wide variety of courses were given this year throughout the division in the professional and technical fields.

More than 1,500 engineers, aid and technicians participated in a 12-hour course, "Inspection Procedures for Portland Cement Concrete Construction," which was presented by headquarters instructors. The course covered new developments in correct procedures for the inspection and testing of portland cement concrete.

An eight-hour "Effective Letter Writing" course was given to 396 right-of-way agents.

Training in the use of electronic data processing for engineering computation was given to 458 engineers.

Within the districts, 153,424 man-hours of training were conducted in a wide variety of technical subjects.

Specialized Programs

Fifty-one employees also participated at state expense in training presented by universities or other educational facilities. These courses introduced new technology or developed needed skills that could not be provided as efficiently through the in-service training program.

Courses covered a wide spectrum of technological training needs; such as "Real Estate Appraisals," "Photogrammetric Methods in Cadastral Surveying," "Advanced Hydrology," "Technique of Using Radioisotopes," "Introduction to Industrial Statistics and Quality Control," "Fundamental Principles of Gas Chromatography Chemistry," "Regional Economic Analysis," and "Analog Computations."

Future Programs

In conjunction with the Governor's Code of Fair Practices, Scott H.

Lathrop was appointed human relations coordinator for the Division of Highways. The role of the human relations coordinator is to promote equal job opportunity and fair employment practices in accordance with the long-established policy of the division.

A training course in "Cultural Differences," to explain and implement the equal opportunity program, was scheduled to be given to all top managers in the fall of 1964, to assure that the Code of Fair Employment Practices is understood and carried out statewide.

EMPLOYEE SAFETY

Assistant Safety Engineer Frank Bunyard (right) discusses a model of work area protection on multilane freeways with District 4 (San Francisco) maintenance personnel.

Safety Committees

There is a division safety committee consisting of the deputy state highway engineer, Administration, as chairman, the division maintenance engineer, the equipment engineer, the engineer in charge of personnel and public information, and an attorney from the Legal Department as members. The safety engineer acts as secretary.

The division safety committee (a) formulates the details of the safety program within whose framework the districts operate; (b) reviews monthly reports of district committees and makes recommendations relative to the problems referred to in them; (c) acts as a clearinghouse for safety ideas and suggestions; (d) reviews and acts on reports of accidents involving Headquarters personnel; and (e) reviews from time to time the effectiveness of the program as carried out.

The district and departmental safety committees are appointed by the district engineers and department heads. They meet monthly and are charged with the following responsibilities:

(a) Reviewing motor vehicle accident reports and deciding on their recordability; (b) interviewing state operators or employees who have been involved in accidents when it is considered advisable; (c) making recommendations as considered appropriate; (d) recommending disciplinary action to the district engineers or department heads when in the judgment of the committee such action is justified; (e) holding monthly meetings, with the reports being submitted to Headquarters; and (f) carrying out an educational program to acquaint highway employees with safe work practices, safety codes, hazardous operations, accident causes, etc.

Safety Supervisors

Each of the 11 districts has a full-time safety supervisor with part-time safety supervisors assigned to the Bridge Department, Service and Supply, Materials and Research, and Equipment Departments. They serve as secretaries to the district and department safety committees, investigate accidents, and do such work as is necessary to carry out the program and assignments determined by the district committees.

Accident Analysis

All personal injuries and motor vehicle accidents involving Division of Highways personnel or equipment are coded and processed by electronic equipment to develop annual and special statistical reports. The "American Standards Method of Recording and Measuring Work Injury Experience" is used as a basis of reporting and recording accidents. Frequency and severity rates are compiled monthly and compared to previous monthly and yearly rates to determine the program's effectiveness.

With minor exceptions, there has been a continuous reduction in frequency rates of both industrial injuries and motor vehicle accidents since the Safety Section was established in 1941. The frequency rate has been reduced from 22.08 in 1953 to 9.93 in 1963. The frequency rate for motor vehicles has been reduced from 1.00 in 1953 to 0.63 in 1963.

The reduction in the personal injury frequency rate has been accompanied by a reduction in the compensation insurance rate per $100 of payroll. In 1953 the compensation rate per $100 of payroll was 0.41 and in 1963 it was 0.37.

The frequency rate for personal injuries is the number of lost-time accidents per million work hours of exposure. For motor vehicles the fre-

quency rate is the number of recordable accidents per 100,000 miles.

The National Safety Council has recognized the 1963 record of the Division of Highways as an outstanding achievement and presented an award for the accomplishment.

Employees of the division who drive highway motor vehicles are given a driver improvement course by the safety section. New employees must be given a road observation run by an instructor or the employee's supervisor before being allowed to drive a state vehicle. The employees must complete the lecture and psychophysical test within three months of their employment.

When an employee has three or more recordable accidents or there is a reason to question his attitude or skill he may be referred to the Department of Motor Vehicles for review of his driving record or may be counseled by representatives of the safety section. If these steps prove ineffective he may be "grounded" or disciplined.

Fire Prevention

The safety section maintains a continuous program of demonstration of fire control by fire extinguishers so that employees are familiar with different types of fire and the characteristics of fire extinguishers and are given an opportunity to use the equipment.

Employee Merit Award Program

The division's employee suggestion program is administered by the headquarters safety section. The section also coordinates the portion of the State Merit Award Board program which provides recognition for special acts, special service and superior accomplishment.

Suggestions submitted during fiscal year 1963–64 totaled 616. This represents an increase of 20 percent over the 1962–63 total of 513. Other figures on the program are as follows:

Number of money awards	56
Amount of money awards	$1,710
Certificates of commendation	22
Total amount of estimated savings resulting from adopted suggestions where savings capable of being measured	$54,900
Total number of suggestions where award presented was based upon intangible savings	38

State Liability for Damage Claims

The safety section coordinates the program of accident investigations with the legal division and the districts if the division may be involved in damage claims.

AUDIO-VISUAL

The audio-visual section originates and produces a wide variety of graphic material and films for use in employee training and public information.

The section maintains a comprehensive library of colored slides on statewide highway scenes, conditions, and operations. It also maintains a variety of film, slide projection, sound recording, and other miscellaneous equipment for departmental use for training or public presentations.

Some of the material produced during 1964 included: publications, reports, or brochures on "WASHO Conference," "Communications Media," "Progress and Needs—County Roads and City Streets," "Scenic Highway Report Supplement"; sound-slide presentation on "Map Reading" for Right-of-Way Training Academy; motion pictures on "Concrete Paving Methods," "Snow Maintenance Equipment," traffic studies on "Freeway Capacity," "Freeway Operation (Grades and Interchanges)," "Bridge Rail Impact tests."

PUBLIC INFORMATION

Progress in the construction and the planning of California's interstate system and other freeways continued to attract public interest during the year, along with increased emphasis on the engineering aspects of traffic safety.

There was also evident an intensified concern with the aesthetic and community values aspects of highway location and design, as reflected in public hearings and in widespread discussion of route locations in the vicinity of state parks. News releases on scenic highways, and particularly an illustrated release on the roadside rest program, received exceptionally wide attention in the press.

The opening of important new sections of freeways and other highways also drew a major share of public attention. These tangible signs of transportation progress (see "California Highways—1964," beginning on page 5) were climaxed in the latter part of 1964 by several major dedications during National Highway Week (October 4–10), plus the opening of the Donner Summit Freeway on Interstate 80 in November.

These opening ceremonies were planned and conducted by local organizations, with the district offices of the Division of Highways supplying information and sketch maps to news media.

News releases were issued on an increasing number of regular developments such as bid advertising and opening, contract awards, completion of projects, speed zones and construction progress, as well as on actions of the California Highway Commission. Several of the district offices also issued periodic comprehensive county-by-county reports on the status of planning, design and construction on various routes.

News releases accompanied by sketch maps were issued in advance of district public hearings in connection with route planning studies.

Displays of freeway interchange models at county fairs and the State Fair were more extensive than ever. Numerous other displays were set up, especially during National Highway Week.

Television Series

Two new ventures in public information were undertaken during the

Scale models of freeway interchanges and other structures planned for the Sacramento area and San Mateo County were featured in an exhibit at the 1964 State Fair. The display, prepared by the Bridge Architectural Section, occupied double the usual space of the Division of Highways exhibits at the fair. Bridge Department representatives were on hand to answer questions.

year. One was a 13-week series of television shows in Los Angeles entitled "King's Highway," featuring freeway developments along with other activities of the Highway Transportation Agency. Another was the neighborhood distribution, with the aid of the Boy Scouts of America, of informational leaflets concerning planned and current highway construction.

Traffic safety information included, in addition to established procedures, the distribution of widely published news releases on special safety projects in each district. Such experiments as fog warning signs and wrong-way ramp warning signs received statewide and even nationwide attention.

Publications

The bimonthly magazine *California Highways and Public Works*, the principal publication of the Division of Highways, continued to serve as a source of general and technical information and as an illustrated chronicle of the state highway program for the employees of the Department of Public Works and for other interested persons. The magazine also served as a source of reprints on a variety of subjects. Prints of its illustrations were supplied on request to many writers and editors all over the world as well as in California.

A leaflet entitled "California's Freeway Planning Team," prepared primarily for the use of legislators and public service organizations, was reprinted during the year.

Thousands of copies of the latest edition of "Freeway Facts" were distributed to persons attending public hearings on freeway routes as conducted by the district engineers of the Division of Highways and by the California Highway Commission.

Employee bulletins were published monthly by each district office and some headquarters departments. Local information was supplemented by material contained in the statewide "Clip Sheet."

Representatives of the division continued to welcome invitations from service clubs, chambers of commerce, neighborhood groups and other organizations to appear and provide information on local and statewide highway matters. They also appeared on television and radio programs, and were available at all times for interviews with newsmen.

Right-of-Way

The land on which state highways will be constructed must be identified, valued, obtained, managed and cleared to receive the proposed facility

Right-of-way Engineering

Few possessions are so rigorously regarded as land, large or small, private or public.

Determining the geographic and legal identity of parcels of land required for right-of-way is fundamental to the acquisition process. Maps must be made, descriptions written and the required areas computed.

The right-of-way engineering unit provides this service for all phases in the right-of-way process, appraisal, acquisition, management, and for itself as keeper of the permanent public record.

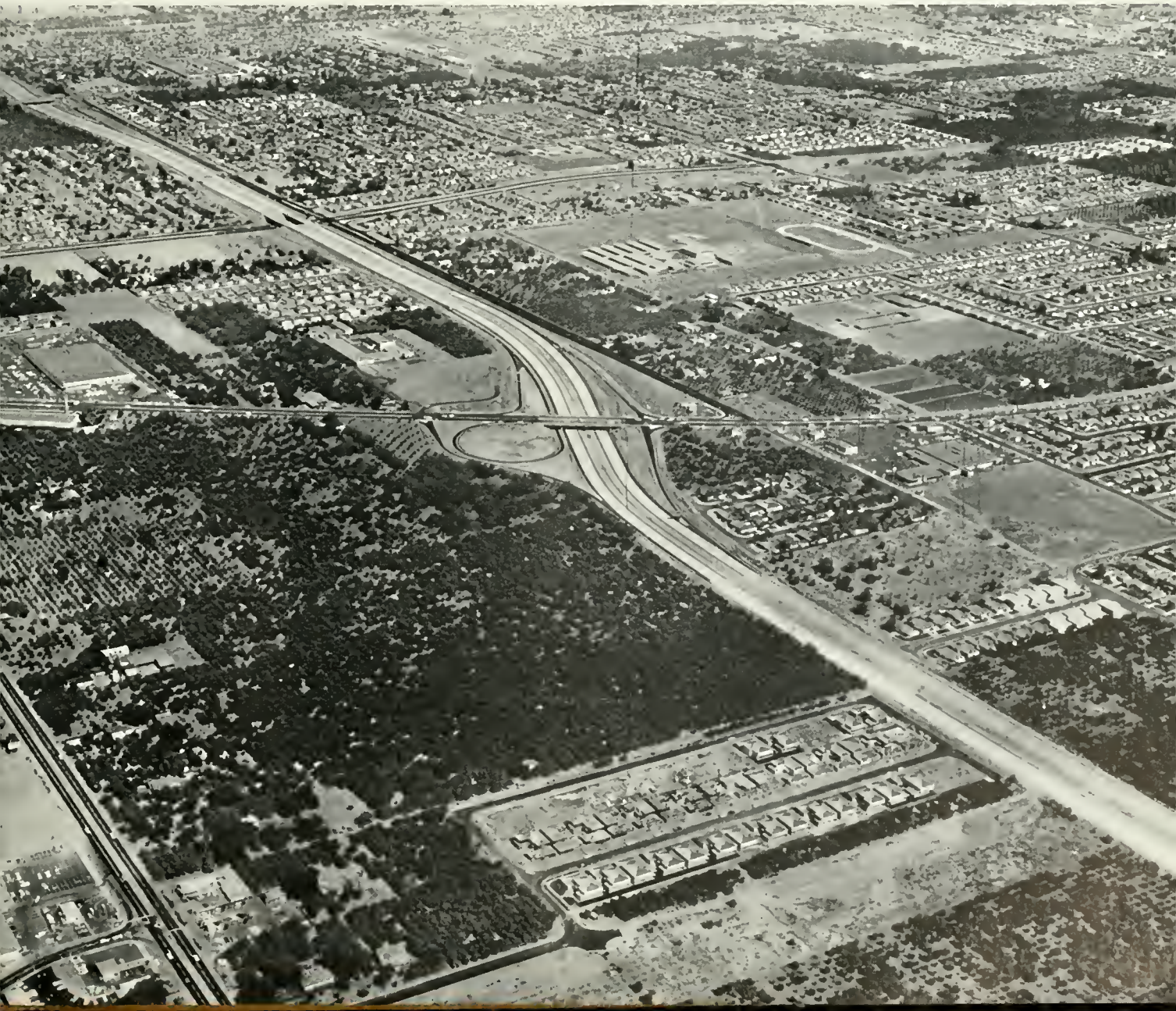
Appraisal

Property owners and taxpayers are particularly concerned with the price which will be paid for right-of-way. The appraisal unit, using universally acknowledged methods, provides valuation reports on every parcel of land to be acquired for highway purpose.

The determination of *fair market value*, that unique price which is willingly offered and accepted in a sale, is the criterion controlling the work of appraisals.

Statewide, at every locale where highway construction will occur, the right-of-way appraiser has made a detailed search and study of the real estate market. Community character, economic environment and sales history are meticulously analyzed and

Interstate 280 will serve an area of Santa Clara County which is rapidly undergoing the transition from agricultural to intensive residential uses. This aerial view shows the completed section eastward from the Sarotoga Avenue Interchange (center), with construction underway on a four-mile section extending westward into Cupertino.



carefully related to the required property.

Acquisition

All other aspects of the right-of-way function are oriented to the support and success of this unit. Its responsibility is to deliver the right of occupancy of required land space into the title of the state, within allotted time.

Negotiated settlement, through amicable relations and mutual respect, is the California policy for right-of-way acquisition. This is accomplished by right-of-way agents who are appreciative of the property owner's circumstances and skilled in the fields of title, escrows and real estate economies.

Despite increasingly complex circumstances, public acceptance of the concepts and practice of the acquisition program is reflected, year after year, in the low percentage of cases involving condemnation. Of all acquisitions this fiscal year, only 3.9 percent required that compensation be determined by contest in the courts.

Property Management

The preceding activities deliver properties of varied character into public ownership. Rarely are they ready for use as right-of-way.

Whether the land is raw or highly improved, the province of property management is to prepare it for the certification—"clear for construction."

The unit also assists both individuals and communities through the transition occasioned by proposed highway construction. Many of the properties are capable of productive interim use. A sound program of rentals, leasing and sale of useful improvements, not only lessens the abruptness of rehabilitation, but in 1963–64 also recovered $15,150,000, thereby effectively stretching right-of-way acquisition dollars.

Relocation advice and assistance is extended on request. Although the relocation advisory assistance program has been widely publicized, only 4 percent of eligible persons subscribed to this available service in 1963–64.

Utilities

The utilities unit's contribution to the production of highway rights-of-way 6.8 percent of the 1963–64 right-of-way expenditures.

The service and supply of commodities furnished by the utilities industry in California (water, power, gas, drainage, sewers), requires a network of facilities second only to highways. Avoidance or adjustment of conflict in these networks is a major concern. A mutual program of planning and cooperation developed and intensified for more than 25 years, has yielded large savings to the public. The effort of the utilities unit in maintaining this accomplishment resulted in 793 separate utilities agreements in the fiscal year with total expenditures of $11,352,537.15.

1963–64 RIGHT OF WAY PROGRAM

Value of parcels acquired		$165,943,691.32
Number of parcels acquired	7,333	
Average value per parcel	$22,629.71	
Utility relocation reimbursements		$11,352,537.15
Acquisitions for other agencies		$4,040,422.66
Total expenditures		$181,336,651.13

In 1963–64 a new cost analysis method was developed whereby productivity in all functions of right-of-way were related to cost. The method yielded accurate, detailed data, identified sources and distribution of costs and made possible specific interdistrict comparisons.

These comparisons have intensified the competition in program accomplishment within the districts and greatly stimulated cost consciousness at all levels in all functions of right-of-way.

Personnel and training are concurrent concerns. Skilled practitioners, experienced in land acquisition are in great demand. Other organizations seek solution of their staffing problems in the ranks of the Right of Way Department. By substituting salaries and shortcut advancement for training time, they lure many competent people.

In 1960–61 the attrition rate was 7 percent; in 1961–62, 9 percent and in 1962–63, 14 percent. Reversal of this trend in 1963–64 with a loss rate of less than 12 percent is attributable to successful efforts in three important areas.

1. The Right of Way Academy was inaugurated. (See *California Highways and Public Works*, September-October 1963)

First of its kind nationally, this intense, indoctrination-level training program consolidated and replaced the district-conducted counterparts. Held for two weeks at the University of California's Davis Campus, it generated an academic atmosphere and "esprit de corps" among agents attending from every district. Being one course compared to the former 11, it attained homogeneity of purpose and process.

Terminations at this personnel level fell from 19.9 to 12.8 percent. Additionally, training costs were cut from an estimated annual figure of $20,870 to an actual sum of $6,777.74, a saving of more than 200 percent.

Salary studies were made which led to the increase of pay scales on January 1, 1964, to be more nearly commensurate with those of external employers. Of the 66 terminations in 1963–64, nearly two-thirds occurred prior to the pay raise.

Promotional procedures were revised to encourage the "career" service of right-of-way agents. The department adapted a procedure whereby evaluation of the candidate's performance is primarily delegated to his closest supervisors. At the same time, advancement avenues were redefined and clarified.

Research and Development

A major source of these tools and methods, enabling management improvement of the production-economy ratio, is right-of-way research and development. During the fiscal year, while analyzing time-cost-production data and conducting special studies for technical growth in right-of-way, it also produced "Glendale Report" (see *California Highways and Public Works*, March-April 1964) and "Community Effects Upon Remainder Parcel Valuation" which was presented at the 43rd annual meeting of the Highway Research Board.

The unit continued to research and relate the impact of freeway location to provide highway planners with useful, valid information in their consideration of community values.

HOTO ABOVE: This televisian camera mounted on the new two lane Caldeott Tunnel bore on Route 24 will keep maintenance personnel posted an raffic conditions. Increasing traffic volume could shaw the need for switching n additional fans and blowers. PHOTO BELOW: The Santa Monica–San Diego Freeway interchange in Los Angeles, laoking sauth along the Son Diega Freeway.

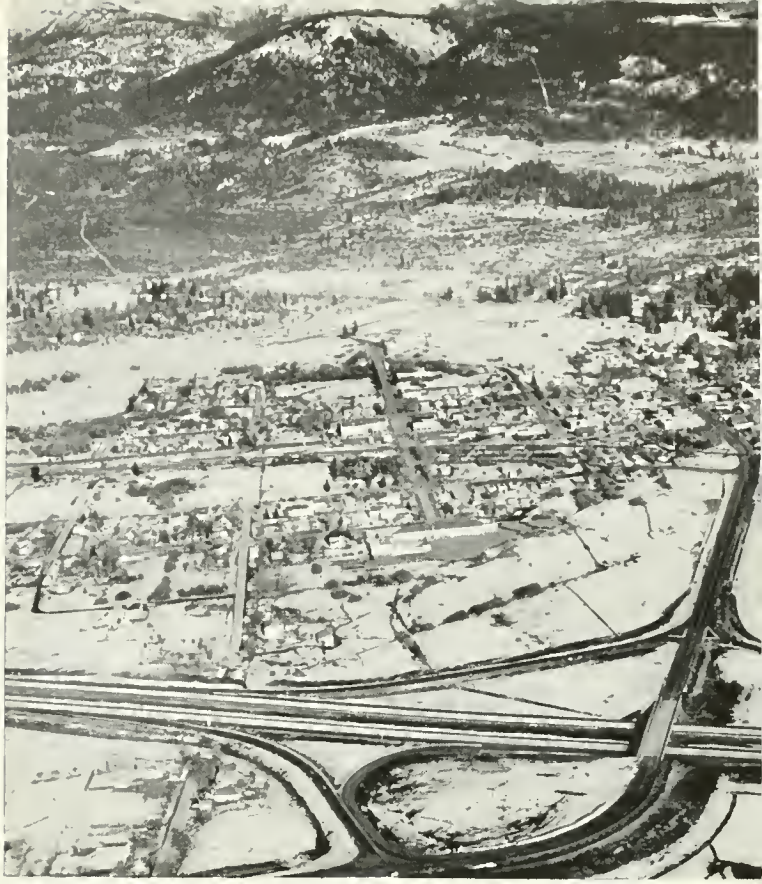


PHOTO ABOVE: A sect:on at the Interstate 5 Freeway near the City of Mount Shasta (fareground) was completed in November. The interchange at Lake Street is at lower right. Lake Street will be extended by the city ta the Everitt Memorial Highway (center of phato), the raute to the ski area. PHOTO BELOW: Looking north along a section of Interstate 580 Freeway thraugh San Leandro, completed this summer. The loop of Grand Avenue (left) was used as a detour during canstruction. The trees across the middle distance delineate San Leandra Creek.

Legal

● *The Division of Contracts and Rights of Way is the Legal Division of the Department of Public Works and renders a variety of legal services to the department and its Division of Highways*

The following tabulations indicate the volume of work performed by the Legal Division involving court appearances before various administrative agencies for the past fiscal year.

Condemnation Proceedings

Some idea of the volume of the condemnation casework is given by the following tabulation: (The parcel count is based on a count of parcels in condemnation resolutions.)

Suits filed	448
Parcels involved	2,163
Defendants involved	14,205
Suits closed	604
Contested trials	266
Uncontested judgments	384
Default judgments	31
Suits pending 7–1–63	1,004
Suits pending 6–30–64	848

The total suits closed, 604, represented total awards of $29,427,868.79 and represented 1,432 days in court.

Appellate Cases

During the fiscal year the Legal Division prepared more briefs and argued more appeals, both in state and federal courts, than in prior years. Decisions were rendered in *People* v. *Jones*, 218 Cal. App. 2nd 747; *People* v. *Lillard*, 219 Cal. App. 2nd 368; *People* v. *Edgar*, 219 Cal. App. 2nd 381; *People* v. *City of Los Angeles*, 220 Cal. App. 2nd 345; *People* v. *Lagiss*, 223 A.C.A. 24; *People* v. *Brusati*, 223 A.C.A. 718; *People* v. *Fink*, 226 A.C.A. 27; *Miles* v. *Superior Court* (unpublished opinion); *U.S.A.* v. *State of California*, 328 F. 2nd 729; and *State of Arizona* v. *State of California*, 84 S.Ct. 1330.

The most unusual decision concerned an attempt by the State of Arizona to invoke the original jurisdiction of the U.S. Supreme Court and sue the State of California and its contractor, Charles L. Harney, Inc., for damages from an automobile accident which occurred on the San Francisco-Oakland Bay Bridge during 1962.

Arizona had paid workman's compensation benefits to one of its employees, the Dean of Women at Grand Canyon College, and alleged that she was injured as a result of a dangerous condition on the bridge.

The U.S. Supreme Court denied the petition of the State of Arizona and which implied that the action should be brought in state court rather than in the U.S. Supreme Court.

In another federal decision, the Court of Appeals for the Ninth Circuit decided in *U.S.* v. *State of California*, that the United States could sue the State of California in U.S. District Court for damages allegedly resulting from negligent acts of state employees in starting a fire in a national forest and in attempting to extinguish it. State highway construction work was being carried on in the Angeles National Forest by the Division of Highways with the assistance of prison inmate laborers.

The Legal Division has filed a petition for a writ of certiorari in the U.S. Supreme Court, contending that the decision is erroneous and that the action cannot be brought against the State of California in the U.S. District Court.

Frontage Road Benefits

Two decisions in condemnation proceedings should prove most helpful in establishing special benefits as a result of the construction of frontage roads. In *People* v. *Lillard*, defendants' property fronted on US 40 and had direct access thereto at three locations. As a result of the condemnation suit, defendants' remaining property had no direct access to US 40, but fronted on a newly constructed frontage road. The jury verdict, awarding defendants nothing for severance damages (and finding special benefits in the amount of $32,000) was upheld on appeal.

The facts were somewhat similar in *People* v. *Edgar*, where defendants former frontage on and access to a state highway were replaced by the construction of a new frontage road. The jury found that the special benefits to the remaining property far exceeded the severance damages, and the judgment was affirmed on appeal.

People v. *City of Los Angeles* was a proceeding to condemn a portion of Griffith Park for freeway purposes. A difficult question had arisen as to the proper method of valuation of park property. The court rejected both the "public trust" theory that the valuation should be nominal when transferred from one public agency to another, and the "federal substitution" rule under which the measure of compensation is the cost of supplying a substitute facility of substantially equal utility. The court also held that it was error to value the property on the basis that it could be used only for park purposes and that it could not be sold. The proper test, the court held, is the fair market value of the property in terms of what private purchasers would be willing to pay for it if it were placed on the market available for all uses to which it is adapted.

Several other cases are now pending before the appellate courts, awaiting argument or decision, including two very important cases involving the constitutionality of the 1963 California Tort Claims Act, which regulates the tort liability of all governmental entities. (*Flournoy* v. *State of California*, and *Hayes* v. *State of California.*)

Other Litigation

In addition to the condemnation proceedings, the department's attorneys handled a large number of miscellaneous cases. The following figures cover a wide variety of litigation and indicate the sizable increase in this phase of the department's work:

At the start of the fiscal year there were 759 cases pending; 738 cases were filed during the year, for a total of 1,497 cases being processed. There were 651 cases closed during the year, leaving 846 cases pending on June 30, 1964.

Some of these cases involve claims for damage to state highway facilities, such as bridges, signals, guardrails, or damage to state vehicles, or unlawful detainer actions. During the fiscal year collections from these cases by the division amounted to $115,531.45.

The case total includes many cases where the department was represented as a defendant, such as inverse condemnation, suits by contractors for additional compensation on construction contracts, proceedings for damage to public property by reason of the state highway operations, and suits filed because of alleged dangerous or defective condition of state highways, and suits for injunction against the state and its contractors enjoining the construction and building of highways.

Other types of suits, such as stop notice actions, are defended by the department, and interpleader actions have been filed by the department in which it assumes a neutral position between the contractor and the party suing on a stop notice.

Proceedings Before Public Utilities Commission

The division handles matters before the Public Utilities Commission having to do with crossings of grade at highways and railroads and the construction of grade separations. The following tabulation indicates the volume of work handled by the division in this category:

Fiscal Year 1963–64	
Applications pending (decisions not issued) 6/30/63	10
Applications pending (decisions issued) 6/30/63	24
New applications filed during year	27
Total applications before P.U.C.	61
Decisions received during year	53
Applications pending, June 30, 1964	8

In addition to formal applications, nine proceedings under P.U.C. General Order 88, relating to crossings at grade, were processed and six are still pending. In all instances the approval of the Public Utilities Commission must be obtained as to engineering details and, in the event of a failure to reach an agreement with the railroad involved as to apportionment of cost, the applicant seeks such determination by the Public Utilities Commission.

A rotary broom cleaning a gutter on the Bayshore Freeway south of San Francisco.

Board of Control and Other Claims

Claims against the state by reason of activities of the department are filed with the State Board of Control. The following tabulation illustrates the volume of work:

	Number of claims	*Amount*
Pending on 7/1/63	153	$12,477,674.27
Filed	387	27,943,087.36
Total	540	$40,420,761.63
Claims disposed of	475	38,368,494.59
Pending 6/30/64	65	2,052,267.04

There was an increase of 78 claims filed over the previous year, amounting to $13,039,956.55. This was an increase of 25¼ percent. The principal types of Board of Control claims as listed above are for negligence, dangerous or defective condition of state highways, breach of contract, and inverse condemnation.

Liability Expanded

The increase in the number of claims filed with the board is due in a large part to the recent decision by the California Supreme Court in the case of *Muskopf* v. *Corning Hospital District*, 55 Cal. 2d 211. This decision greatly expanded the liability of the state, particularly for accidents arising out of the dangerous or defective conditions of state highways.

The 1963 session of the Legislature enacted Chapter 1681, which expands the liability of the Department of Public Works. The legislation makes the state liable for the negligent acts or omissions of its employees as well as for the dangerous condition of public property, including state highways. This liability will necessitate the careful investigation by Division of Highways personnel of all claims. Because of the *Muskopf* decision and this legislation, the number of claims have increased substantially as well as the work in investigating these claims and the handling of the resulting litigation.

Contractors' claims before the State Highway Engineer's Board of Review for additional compensation have increased notably. These claims have required considerable work, both in the analysis and handling of claims and in the resulting litigation. Directly proportional to the number of Board of Review hearings is the increased number of lawsuits against the department arising out of construction contract claims.

House Counsel Work

The "house counsel work" of the division has also shown a decided increase. This work consists of legal opinions directed towards preventing litigation rather than engaging in litigation after damage has occurred.

Other routine work has increased, such as approval of contracts and leases, reviewing forms and accident reports. This work is directly proportional to the increased volume of the highway program. In addition, there were 33 contested hearings before the State Personnel Board, an increase of 3 over the previous fiscal year.

Fiscal Management

- *Administration of all accounting activities of the Division of Highways, and the other Divisions of the Department of Public Works, is under the direction of the Comptroller of the Division of Highways and his staff*

Organization

Organizational changes during the fiscal year included the establishment of a position of Deputy Comptroller and four Assistant Comptrollers, with each of the Assistant Comptrollers responsible for one of the following areas:

1. Budgetary and control and toll bridge accounting,
2. General administrative accounting,
3. Federal aid and special activities, and
4. Accounting systems.

The accounting function of the City and County Projects Department was transferred to the Fiscal Management Department, although the physical location remained in the City and County Project Department to facilitate the work without creating duplicate files.

With the establishment of the Division of Bay Toll Crossings on November 18, 1963, many accounting changes were necessary to accommodate the responsibilities assigned to this division which had not been performed by the superseded Division of San Francisco Bay Toll Crossings. These new responsibilities included the operation and maintenance of existing toll bridges, formerly a Division of Highways Bridge Department responsibility, and the planning for new toll crossings in various areas of California. The Bay Bridge Accounting Office was transferred from the Division of Highways to the Division of Bay Toll Crossings.

The accounting function for the Division of Aeronautics was transferred from the Department of General Services to the Division of Highways.

Fiscal Management Improvement

1. The backlog of unbilled federal reimbursement was reduced $22,800,000. This compares with the reduction of $18,000,000 during the preceding year. Not only did this improve the cash balance of the State Highway Fund, but it also increased revenues through investment of temporary cash surpluses.

2. A procedure was developed to charge use of construction warning signs against highway projects on a rental basis. The new procedures, will permit the collection of approximately $100,000 additional per year of federal funds on interstate highway projects.

A seminar for district accounting officers of the Division of Highways was held in Sacramento on June 4 and 5, 1964.

3. In May 1964, approval of the Bu-eau of Public Roads was obtained for ie reimbursement of state audit costs connection with the examination of orce accounts of contractors working nder the provisions of a federally ap-roved construction agreement relat-ig to the interstate program.

4. The payment for credit card de-veries of petroleum products was iifted to the Equipment Department. This change permitted a more efficient andling of voluminous delivery tags nd facilitated the adoption by the quipment Department of equipment ites covering complete costs of oper-tion.

5. The consolidated reporting of iles of tangible personal property was hifted from the Equipment Depart-ient to the Fiscal Management Office. This resulted in more efficient report-ig to the Board of Equalization for iles tax collected by the Division of Highways, and eliminated one copy f accounts receivable invoices.

6. Effective January 1, 1964, a pro-edural change affecting deposits in he Condemnation Deposit Fund was dopted which expedited federal re-mbursement covering such deposits or acquisition of rights-of-way on the nterstate highway system. This revi-ion improved the cash position of the State Highway Fund by approxi-nately $11,000,000.

7. Between May 1963 and January 1964, the accounting input equipment n the district offices was replaced with keypunches and verifiers which ire compatible with the Headquarters Office computers.

Toll Bridges

The establishment of the Division of Bay Toll Crossings on November 18, 1963, with complete responsibility for toll bridge operations, as well as construction, did not remove toll bridge accounting, fiscal and insurance responsibilities from the Fiscal Man-agement Department of the Division of Highways. The involvement of the Fiscal Management Department arises from:

1. Director of Public Works Order General No. 6, naming the Comptroller of the Division of Highways as the Chief Fiscal Officer of the Division of Bay Toll Crossings, and

2. Appropriations from the State Highway Fund for toll bridge maintenance, toll crossing feasibility, studies, and preliminary engineering of approved crossings.

During the year, a number of important toll bridge financing and fiscal matters required active participation by the Fiscal Management Department. Seven of these are cited:

1. *Carquinez Strait Bridges Refunding Bonds*

The unusually favorable bond market in the summer of 1963 led to a recommendation to the Toll Bridge Authority to authorize the sale of refunding bonds in the amount of $75,000,000 to refund the oustanding Carquinez Strait bridges bonds. In all, considering the cost of the call premiums on the outstanding $33,390,000 of Series B bonds, there was a net interest saving of approximately $1,000,-000 on this transaction. Another major benefit of the preceding transaction was that it freed $10,000,000 for the construction of an additional bridge approach from IS 80, in the vicinity of Cordelia, to the Benicia-Martinez Bridge. This could not have been done until the restrictions of the prior bond issue were eliminated by the retirement of outstanding bonds. This 12-mile connection to the Benicia-Martinez Bridge from IS 80 is thus being provided years before it could have been constructed with State Highway Fund money.

2. *San Francisco-Oakland Transbay Tube*

Sections 30770–30782, of the Streets and Highways Code, pledge toll revenue of the three bond-free bay bridges, earned after December 31, 1964, to pay the cost of construction of the Transbay Tube for rapid transit. An agreement has been executed between the Department of Public Works and the Bay Area Rapid Transit District (BARTD), providing for progress payments to BARTD not to exceed $4,500,000, to finance the cost of preliminary engineering and right-of-way.

3. *San Diego-Coronado Bridge*

The California Toll Bridge Authority, on May 14, 1964, authorized the Department of Public Works to proceed with the design and acquisition of right-of-way for a toll bridge from San Diego to Coronado. Funds totaling $3,600,000 have been appropriated from the State Highway Fund by the Legislature to cover these costs. Highway funds expended are repayable from proceeds of the sale of toll revenue bonds.

4. *Southern Crossing Studies*

Financial and engineering studies are in progress to determine the feasibility of constructing additional toll crossings of San Francisco Bay south of the San Francisco-Oakland Bay Bridge. The location, design, and number of additional crossings have not yet been established, but the Fiscal Management Department produced several financial projections to assist the Toll Bridge Authority in considering the financing problems.

5. *Vincent Thomas Bridge Opening*

On November 15, 1963, the Vincent Thomas Bridge, between San Pedro and Terminal Island, was opened to toll traffic. Fiscal Management established a bridge operating fund with the State Treasurer and provided the Division of Bay Toll Crossings with accounting procedures.

6. *Toll Bridge Insurance*

The Comptroller of the Division of Highways is responsible for administering the toll bridge insurance program. Present insurance coverage on all toll bridges is $195,000,000, of which $163,000,000 is physical damage insurance, and $32,000,000 is use and occupancy insurance. During the 1963–64 fiscal year, a major accomplishment was the renewal and increase of the physical damage insurance on the San Francisco-Oakland Bay Bridge to $55,000,000. Previously, the most coverage that could be ob-

tained for the "Bay Bridge" was $33,008,494, with an additional $9,037,500 for a loss in excess of $40,000,000. It would be desirable to carry coverage in the amount of 80 percent of the replacement value, the amount specified in bond resolutions for bonded bridges.

7. Investment of Funds

The Comptroller also administers the temporary investment of toll revenue funds and bond funds in U.S. government securities. On June 30, 1964, the par value of investments held for toll bridge funds by the State Treasurer amounted to $61,865,000. Investment income for the year was in the total amount of $2,326,227.94.

Training Activities

A major effort of the Fiscal Management Department during the year consisted in participation for preparation for a simplified accounting system to be installed July 1, 1964. As a portion of this effort, an extensive training program was conducted. This consisted of three subprograms:

1. Training of 1,400 management, engineering and right-of-way personnel at the senior level and above. This training was conducted by a four-man team, headed by the division training officer. This training effort occupied a major portion of the time of these team members from November 1963 through April 1964.

2. Training of accounting personnel in all districts and at Headquarters. This training consisted of five full days of instruction in each district, and was conducted by another four-man team, headed by the assistant division training officer, supplemented by three representatives of Headquarters Office Fiscal Management Department. During the final month, a representative of District 7 replaced one of the fiscal management members. This training required the full time of this team from January 1964 through June 1964. *(See photo on page 58.)*

3. An intensified training for district accounting officers in a two-day seminar, June 4–5, 1964. *(See Photo.)*

Because of the large backlog of unbilled federal aid and the loss of several key staff members, an intensified training program was conducted in federal aid vouchering procedures from October 1963 through January 1964.

In order to insure effective performance of the accounting function for the city and county projects unit, on April 21–22, 1964, a two-day training course was conducted at Headquarters for two representatives from each district. This course covered the statutes, including the new Collier-Unruh Local Transportation Act, administration problem solving, and methods, forms, and procedures applicable to this accounting function. This course was followed by a four-hour training session in five districts, where a need for additional training developed.

Financial Data

Budgeted revenues for the 1963–64 fiscal year amounted to $781,847,768, of which $264,186,121 remained to be collected on June 30, 1964. Revenue not received consists of $250,670,562 of federal aid and $8,516,259 contributions from state and local agencies and other sources, which will be collected as applicable work is completed. Expenditures and obligations incurred applicable to the fiscal year ended June 30, 1964, amounted to $733,543,416.

Freeway construction on Route 58 in mountainous terrain west of Tehachapi, Kern County.

1965-66 Highway Budget

The California Highway Commission on October 30 budgeted $612,432,000 for state highway construction purposes, including rights-of-way and engineering, for the 1965–66 fiscal year.

This figure, up $34,020,000 from the 1964–65 highway budget adopted a year ago, contains $431,781,000 for major construction and improvement (including engineering); $158,651,000 for rights-of-way; plus smaller amounts for contingencies, resurfacing programs, signs and striping, traffic safety projects, highway planning studies and minor improvements.

In submitting the budget to Governor Edmund G. Brown, Robert B. Bradford, chairman of the commission and Administrator of the Highway Transportation Agency, pointed out that the newly adopted budget will provide for about 350 miles of new multi-lane freeways and adding lanes on another 37.2 miles of existing freeways.

"Freeways are well recognized as the best solution to the safety problem on our overcrowded highways," Bradford said. "We wish we could finance all the needed freeways at once. In line with Governor Brown's emphasis on maximum traffic safety, the new budget also provides substantial funds for spot safety projects as curve correction, widening, and channelization on certain sections where freeway construction is not yet feasible."

Construction emphasis in the new budget continues on California's 2,173-mile share of the national system of interstate and defense highways. The budget contains $317,442,281 in federal funds, of which $266,988,400 is included for the completion of this system, which by federal law, must be accomplished by 1972.

"As in the past few years," Bradford said, "our progress on the interstate freeway system is on schedule except in San Francisco. We placed our early interstate moneys on freeway routes in the more expensive metropolitan areas where traffic volumes were greatest. Now we are concentrating on interstate projects connecting these metropolitan areas and on long sections in more rural and desert areas.

"For example," he continued, "the new budget authorizes projects costing nearly $50,000,000 to construct 13 miles of the eight-lane Interstate 5 Freeway, and to do the heavy grading for an additional 12.4 miles, in the difficult terrain along the Ridge Route south of the Kern-Los Angeles county line.

"Also, the new budget provides funds for projects totaling more than $34,000,000 on the Westside Freeway (Interstate 5 and 580), a new route along the west side of the San Joaquin Valley, with spurs to the San Francisco Bay and Stockton-Sacramento areas.

"This money will buy about 42 miles of full freeway in Merced, Stanislaus and southern San Joaquin Counties," Bradford said, "plus an additional 45 miles of preliminary construction work in Fresno and Kern Counties."

He noted that when two projects already under construction and the 42-mile section are completed, motorists will be able to travel from the San Francisco Bay area to US 99 south of Chowchilla in Madera County via the Westside Freeway and Route 152 easterly from near Los Banos, pending completion of the southerly section of the Westside Freeway a few years hence.

The commission chairman added that the new budget provides $6,229,000 for landscaping, functional and tree planting along various freeway routes.

As it did last year, the commission approved some projects which are only partly financed in the 1965–66 budget, but which under current federal and state procedures can be placed under contract in their entirety with the assurance that the balance will be included in the 1966–67 budget.

It also allocated $48,740,000 to finance the balance of projects totaling $106,602,000, which were approved in the 1964–65 budget.

In addition to the construction items, the commission budgeted $79,200,000 for state highway purposes other than construction, including $48,000,000 for maintenance; $15,500,000 for administration; $6,050,000 for maintenance of landscaping, functional planting and safety roadside rests; $5,000,000 for buildings and land; $3,500,000 for highway research and development; $1,100,000 for honor camps; and $50,000 for legislative claims.

A third budget segment totaling $149,401,526 was allocated for functions not under state highway jurisdiction.

The largest nonstate highway items are $72,502,857 for construction and rights-of-way for streets and roads on the select system of cities and counties as established by the 1963 Legislature, and $50,492,857 for improvements and maintenance work on city streets.

The other such items are $8,600,873 in federal aid for county roads on the federal aid secondary system, and $4,107,439 in state funds to counties for use in matching these federal funds; $5,000,000 in state funds to help finance railroad grade separation projects on local streets and roads; $3,396,500 in state funds to pay part of the cost of extending federal aid secondary county roads into urban areas; $3,670,000 for maintenance of state-owned toll bridges; $1,500,000 in engineering funds for cities; and $131,000 for administration of the Outdoor Advertising Act.

The total estimated revenue from all state sources is $514,990,758, a gain of $33,705,336 over such revenue for the present fiscal year. It will derive from $375,339,286 in gasoline taxes, $90,720,472 in motor vehicle fees, $29,800,000 in taxes on diesel fuel, $15,500,000 in taxes on for-hire vehicles, $3,500,000 in interest, and $131,000 in outdoor advertising fees.

1965-66 State Highway Budget by Region, Counties

NOTE 1—The term "freeway" means a multilane divided highway with full access control, no crossings at grade, no stoplights and no left-turn movements. An "expressway" has the same access control as the freeway but does permit left turns and crossings at grade at some intersections which may or may not be signalized. "Two-lane expressways" are two-lane highways with some measure of access control, and are usually planned for future expansion to four lanes.

NOTE 2—Projects which overlap county lines are listed in both counties.

NOTE 3—Construction contracts financed in this new budget may be awarded beginning January 1965; right-of-way funds may not be spent until July 1, 1965, the start of the fiscal year.

NOTE 4—At the 1963 session of the Legislature, a bill was passed which renumbers the state highway routes effective July 1, 1964. Projects in this budget are listed by both old and new route designations. If only one route number appears, the route number will not change.

NORTH COASTAL COUNTIES PROJECTS

Del Norte County

Complete paving of the two- and four-lane US 101 Freeway between 0.9 mile south of the Humboldt-Del Norte county line and 0.2 mile north of its junction with Route 169, a distance of 5 miles. Estimated cost, $1,300,000. (Grading, construction of an interchange with Route 169, and construction of a bridge across the Klamath River and its overflow channel are in progress.)

Humboldt County

Extend the four-lane US 101 Freeway (under construction or completed between Dean Creek south of Phillipsville and Englewood) another 7.7 miles northerly to 4.2 miles south of Scotia, with interchanges at Redcrest, the southern entrance to Pepperwood, and the old US 101 Highway south of Jordan Creek. Estimated cost, $7,100,000.

Complete paving of the two- and four-lane US 101 Freeway between 0.9 mile south of the Humboldt-Del Norte county line and 0.2 mile north of its junction with Route 169, a distance of 5 miles. Estimated cost, $1,300,000. (Grading, construction of an interchange with Route 169, and construction of a bridge across the Klamath River and its overflow channel are in progress.) (This project repeated above in Del Norte County.)

Construct a bridge across Redwood Creek on Route 299 approximately 1 mile south of the existing bridge, 16 miles east of Blue Lake. Estimated cost, $515,000. (This project is part of two-lane expressway construction, completed or in progress, between Lord Ellis Summit, 12.6 miles east of Blue Lake, and 2.2 miles east of Redwood Creek.)

Replace a structurally inadequate bridge across Willow Creek on Route 96 and construct 0.6 mile of two-lane expressway approaches in Willow Creek. Estimated cost, $415,000.

Improve curves on portions of Route 36 between 1.5 and 9.6 miles east of Bridgeville. Estimated cost, $100,000.

Rights-of-way on various state highway routes—$935,000.

Lake County

Construct a two-lane expressway on Route 29 between 1 mile south of Kelseyville and Route 175, a distance of 6.2 miles. The project involves constructing a bridge across Kelsey Creek. Estimated cost, $1,900,000.

Rights-of-way on various state highway routes—$240,000.

Mendocino County

Construct 1 mile of Route 1 on new alignment to replace an existing bridge across Mallo Pass Creek with a reinforced concrete arch culvert, approximately 11 miles north of Point Arena. Estimated cost, $870,000.

Replace a structurally deficient overhead on US 101 across the Northwestern Pacific Railroad tracks, approximately 1.4 miles south of Hopland, with a new structure on same alignment. Estimated cost, $170,000.

Rights-of-way on various state highway routes—$765,000.

SACRAMENTO VALLEY AND NORTHERN VALLEY PROJECTS

Butte County

Widen Route 99 from two to four lanes between 1 mile south and 0.3 mile north of Gridley. Estimated cost, $300,000, of which the state will pay $290,000, and the city and county the balance.

Rights-of-way on various state highway routes—$35,000.

Colusa County

Rights-of-way on various state highway routes—$735,000.

El Dorado County

Widen an existing two-lane section of US 50-Route 89 to four lanes between 0.8 mile and 0.2 mile south and between 0.2 mile and 1.5 miles north of the Tahoe Valley Wye. Estimated cost, $310,000.

Add passing lanes on US 50 3 miles west of Strawberry and just east of Phillips. Estimated cost, $300,000.

Rights-of-way on various state highway routes—$930,000.

Glenn County

$3,851,000 to complete the financing of two four-lane freeway projects on Interstate 5 between two miles south of Willows and the Tehama county line, with interchanges at Route 162 in Willows, County Roads 39, 33, 57B, 16, 7, and Route 32-Newville Road. The project includes extending Route 162 and Route 32 westward from their present termini at the existing highway in Willows and Orland to the new freeway. Estimated cost, $11,651,000, of which $7,800,000 was budgeted in the 1964-65 fiscal year.

Rights-of-way on various state highway routes—$100,000.

Lassen County

Construct a two-lane expressway on Route 36 between 1 mile west of Devil's Corral and 0.6 mile west of Eagle Lake Road, and widen and add a truck climbing lane for westbound traffic between 0.6 mile west of Eagle Lake Road and Main Street in Susanville, a distance of 8.2 miles. Estimated cost, $2,030,000.

Rights-of-way on various state highway routes—$50,000.

Modoc County

Construct a two-lane expressway on US 395 between 0.5 mile north of the Lassen county line and Jess Valley Road at Likely, a distance of 2.9 miles. (This will complete two-lane expressway construction between 1 mile south of the Lassen-Modoc county line and 6 miles south of Alturas, except for a short section in Likely.) Estimated cost, $430,000.

Rights-of-way on various state highway routes—$90,000.

Nevada County

Rights-of-way on various state highway routes—$350,000.

Placer County

Widen the Rocky Ridge Road Interchange and revise ramps on the Interstate 80 Freeway in Roseville to accommodate the widening of Rocky Ridge Road from two to four lanes and the future widening of Interstate 80 from four to six lanes. Estimated cost, $970,000.

Construct interchanges on Interstate 80 at Illinoistown and Heather Glen, approximately 1 mile west of Weimar, converting an expressway section to full freeway (and extending completed full freeway from the Nevada state line to Applegate). Estimated cost, $980,000.

Rights-of-way on various state highway routes—$750,000.

Plumas County

Construct truck climbing lanes, resurface d improve the banking of curves on oute 89 between 1 mile north of Crescent ills and 1.5 miles south of Greenville, a stance of 1.6 miles. Estimated cost, $210,000. Rights-of-way on various state highway utes—$180,000.

Sacramento County

Construct the eight-lane Interstate 80 Freeay in Sacramento in two units between the est side of Fifth Street and Alhambra oulevard, a distance of 2.3 miles, which gether with the 29-30th Street (Interstate) Freeway, already under construction or idgeted, will complete freeway construcon on this route through the city. Estiated cost, $19,100,000, of which $9,900,000 ill be budgeted in the 1966-67 fiscal year. $5,410,000 to complete the financing of e superstructure of the eight-lane Interte 80 Freeway bridge across the Sacraento River, between Jefferson Boulevard Yolo County and Fifth Street in Sacraento. Estimated cost, $16,410,000, of which 1,000,000 was budgeted in the 1964–65 fisl year.

$2,974,000 to complete the financing of e eight-lane Interstate 80-99 Freeway beeen 0.2 mile south of Fifth Avenue and l mile north of A Street in Sacramento, distance of 2.9 miles. Estimated cost, $11,-4,000, of which $8,750,000 was budgeted the 1964–65 fiscal year.

Widen the Interstate 80 Freeway, includg the American River Bridge near Elvas om four to six lanes between A Street in cramento and the North Sacramento reeway, just south of the Arden Way Inrchange a distance of 2.2 miles. Estimated st $1,400,000.

Landscape and plant trees along the Inrstate 80 Freeway between the Elvas nderpass in Sacramento and 0.4 mile east Arden Way a distance of 2 miles. Estiated cost, $150,000.

Widen the Route 160 Freeway from four six and seven lanes between Sproule reet, just south of Richards Boulevard in cramento, and 0.1 mile east of the North cramento Undercrossing, a distance of 1.1 iles. The project involves widening the th Street Bridge across the American iver and the North Sacramento Viaduct. stimated cost, $2,100,000.

Construct an initial two-lane expressway n the alignment of the future four-lane nterstate 5 Freeway between near Route 9 at El Centro Road in Sacramento and Garden Highway near the Elkhorn Ferry, a distance of 4.8 miles. Estimated cost, $1,-250,000.

Rights-of-way on various state highway routes—$13,990,000 (including $10,000,000 on Interstate 5 in the vicinity of Sacramento).

Shasta County

Construct the four-lane Interstate 5 Freeway between 1.9 miles north of O'Brien and the south end of the Sacramento River Bridge at Antler, a distance of 4.6 miles. The project involves construction of an interchange with county roads at Salt Creek. Estimated cost, $4,650,000, of which $1,550,-000 will be budgeted in the 1966–67 fiscal year.

Place base and surface to complete the four-lane Interstate 5 Freeway between the Sacramento River north of Anderson and two miles north of Redding, extending freeway construction now in progress through Anderson another 11.9 miles northerly. Estimated cost, $4,180,000.

$1,620,000 to complete the financing of the state's share of construction now in progress on the four-lane Interstate 5 Freeway between two miles north of the Shasta-Tehama county line and the Sacramento River north of Anderson, a distance of 5 miles, with interchanges at South Anderson, Deschutes Road, Balls Ferry Road, North Street and Riverside Avenue, and a grade separation between Deschutes Road and the Southern Pacific Railroad. Estimated cost, $4,156,000, of which $2,400,000 was budgeted in the 1964–65 fiscal year. The county and Anderson will pay an estimated $136,000 for the grade separation with the railroad.

Construct truck climbing lanes and channelization on portions of Route 299 between 5.8 miles west and 3.4 miles east of Montgomery Creek. Estimated cost, $125,000.

Replace an inadequate timber bridge on Route 299 across Churn Creek with a concrete structure, approximately 1.6 miles east of Interstate 5. Estimated cost, $75,000.

Rights-of-way on various state highway routes—$1,060,000.

Sierra County

Extend the two-lane Route 49 Expressway (between Bassetts and 0.8 mile east of Sierra City) westerly to Sierra City. Estimated cost, $190,000.

Siskiyou County

Construct the Hilt Road Interchange and add two lanes to convert the existing two-lane US 99 highway to four-lane Interstate 5 Freeway between the Oregon state line and 1.5 miles southerly. Estimated cost, $1,-720,000.

Rights-of-way on various state highway routes—$810,000.

Sutter County

Install traffic signals, construct left-turn storage lanes and widen Route 99 from two to four lanes between 0.3 mile south of Franklin Road and 0.4 mile north of Bridge Street in Yuba City, a distance of 1.1 miles. Estimated cost, $130,000, of which the state will pay $110,000, and the city and county the balance.

Rights-of-way on various state highway routes—$700,000.

Tehama County

$1,200,000 to complete the financing of construction now in progress on the four- and six-lane Interstate 5 Freeway between Corning Road and Kimball Road at Red Bluff, a distance of 16.1 miles, with interchanges at Finnel Avenue, Gyle Road, Flores Avenue and South Red Bluff. The six-lane section will be between the South Red Bluff Interchange and 2.3 miles southerly. Estimated cost, $7,750,000, of which $6,550,000 was budgeted in 1964–65 fiscal year.

Construct the four-lane Interstate 5 Freeway between the Glenn-Tehama county line and Corning Road, a distance of 9.3 miles, with interchanges at Liberal Avenue, South Avenue and Corning Road. Estimated cost, $4,650,000. (This construction will connect a recently started project between 1 mile north of Artois and the Glenn-Tehama county line with construction in progress to 0.6 mile north of Red Bluff, a total distance of 41.3 miles.)

Rights-of-way on various state highway routes—$100,000.

Trinity County

Construct truck climbing lanes on Route 299 between 2.9 miles and 5 miles east of Douglas City. Estimated cost, $385,000.

Rights-of-way on various state highway routes—$90,000.

Yolo County

$5,410,000 to complete the financing of the superstructure of the eight-lane Interstate 80 Freeway bridge across the Sacramento River, between Jefferson Boulevard in Yolo County and Fifth Street in Sacramento. Estimated cost, $16,410,000, of which $11,000,000 was budgeted in the 1964–65 fiscal year.

Rights-of-way on various state highway routes—$910,000.

Yuba County

Rights-of-way on various state highway routes—$25,000.

SAN FRANCISCO BAY REGION PROJECTS

Alameda County

Extend the Interstate 680 Freeway 8.7 miles northerly from Route 84 near Scotts Corner to construction now in progress between south of Interstate 580 and one mile north of the Alameda-Contra Costa county line. The project involves construction of interchanges at Route 84, Sunol Road, Pleasanton-Sunol Road, Vernal Avenue, and twin bridges across the Arroyo de la Laguna. This project, together with a previously budgeted project between 0.9 mile north of the Alameda-Contra Costa county line and Danville, will complete the Interstate 680 Freeway from Fremont in Alameda County to Vallejo in Solano County. Estimated cost, $8,450,000, of which $4,335,000 will be budgeted in the 1966–67 fiscal year.

Widen the Route 17 (Nimitz) Freeway from four to six lanes between Route 92 (Jackson Street) in Hayward and Washington Avenue in San Lorenzo, a distance of 4.2 miles. Estimated cost, $1,300,000.

Resurface pavement and shoulders on the Route 17 (Nimitz) Freeway between 1.1 miles north of Washington Avenue and 0.3 mile north of Davis Street (Route 112) in San Leandro, a distance of 2 miles. Estimated cost, $300,000.

Landscape the Interstate 580 Freeway between Gabriel Court in San Leandro and 0.1 mile west of 108th Avenue in Oakland, a distance of 1.9 miles. Estimated cost, $200,000.

Widen Mission Boulevard (Route 238) from two to four lanes at Driscoll Road in Fremont, and install traffic signals. Estimated cost, $120,000, of which the state will pay $100,000 and the city the balance.

Rights-of-way on various state highway routes—$14,405,000 (including $5,800,000 on Interstate 580 in the Castro Valley area, and $5,150,000 on the Route 24 Freeway in Oakland.

Projects under the city and county urban extension program:

Widen one-half mile of Hesperian Boulevard to six-lane divided highway between State Route 17 and State Route 238 in San Leandro urban area. Estimated cost $548,000 (state's share $274,000).

Construct 0.3 mile of Redwood Road between Joseph Drive and Buti Park Drive in Hayward urban area as four-lane undivided highway. Estimated cost, $240,000 (state's share $120,000).

Construct one-half mile of Lake Chabot Road between Castro Valley Boulevard and Somerset Avenue in Hayward urban area as four-lane, undivided highway. Estimated cost, $250,000 (state's share $125,000).

Contra Costa County

$2,300,000 to complete financing of a budgeted project to construct the six-lane Interstate 680 Freeway between 0.9 mile north of the Alameda county line and one mile south of Danville, a distance of 5.5 miles, with an interchange at Crow Canyon Road, completing freeway construction between Dublin and Walnut Creek. Estimated cost, $7,000,000, of which $4,700,000 was budgeted in the 1964–65 fiscal year.

Landscape the Interstate 680 Freeway between Walden Road and the south city limit of Concord, a distance of 3.2 miles. Estimated cost, $235,000.

Install trees and functional planting on portions of Interstate 680 between 0.3 mile south of Sycamore Valley Road and 0.2 mile north of Crest Avenue in Walnut Creek. Estimated cost, $150,000.

Rights-of-way on various state highway routes—$720,000.

Projects under the city and county urban extension program:

Widen 0.6 mile of Concord Avenue between Walnut Creek Channel and Market Street in Concord to four-lane, divided highway and construct parallel bridges. Estimated cost, $1,000,000 (state's share, $500,000).

Marin County

Extend Tiburon Boulevard (Route 131) 1 mile easterly as a four-lane highway from Blackfield Drive to Reed Ranch Road, grade an additional 0.4 mile, and place rock riprap protection along Richardson Bay to 0.7 mile west of San Rafael Avenue, approximately 2 miles west of Tiburon. Estimated cost, $610,000.

Construct parking facilities on the west side of US 101 immediately north of the Golden Gate Bridge to permit southbound motorists to use an existing pedestrian walkway to Vista Point, overlooking San Francisco Bay. Estimated cost, $65,000.

Rights-of-way on various state highway routes—$800,000.

Napa County

Convert the two-lane Route 29 Expressway to four-lane freeway between Napa Creek and 0.1 mile south of Trancas Street-Redwood Road in Napa, a distance of 1.3 miles, with an interchange at Lincoln Avenue. Estimated cost, $1,305,000, of which the state will pay $1,260,000, and the city and county the balance.

Widen portions of Route 128 between Route 29 and Route 121, approximately 12.5 miles east of Rutherford. Estimated cost, $50,000.

Rights-of-way on various state highway routes—$245,000.

San Francisco County

Extend the six-lane Route 82 Freeway construction now in progress (between Newcomb Avenue and Army Street) northeasterly to the site of the Islais Creek Interchange with the future freeway via Hunters Point, thence northerly as the eight-lane Route 87 Freeway to 0.1 mile north of 18th Street, a distance of 1.4 miles. Estimated cost, $9,500,000, of which $2,800,000 will be budgeted in 1966–67 fiscal year.

Landscape the Route 82 Freeway between San Jose Avenue and 0.4 mile north of Ocean Avenue, a distance of 1.3 miles. Estimated cost, $135,000.

Landscape portions of the Route 82 Freeway between the James Lick Memorial Freeway (US 101) and Revere Avenue. Estimated cost, $60,000.

Rights-of-way on various state highway routes—$6,555,000.

San Mateo County

$8,625,000 to complete the financing of a budgeted project to construct the eight-lane Interstate 280 Freeway between Eastmoor Avenue in Daly City and 0.5 mile south of Arroyo Drive west of South San Francisco, a distance of 3.3 miles, with interchanges at Westborough Boulevard, the future Hickey Boulevard Extension at Collins Avenue, and the future Route 1 Freeway. Estimated cost, $10,425,000, of which $1,800,000 was budgeted in the 1964–65 fiscal year.

Rough grade portions of the Interstate 280 Freeway between Summit Drive in Hillsborough and Larkspur Drive in Millbrae, and construct an eight-lane freeway on this route between Larkspur Drive and 0.3 mile south of Route 186 in San Bruno, with interchanges at Skyline Boulevard (Route 35) and Junipero Serra Boulevard (Route 117), a distance of 2.2 miles; and rough grade portions for a four-lane freeway on Route 1 between St. Francis Boulevard in Daly City and Interstate 280. Estimated cost, $9,700,000, of which $5,500,000 will be budgeted in the 1966–67 fiscal year.

$4,785,000 to complete the financing of an eight-lane bridge for the future Interstate 280 Freeway across San Mateo Creek in and near Hillsborough. Estimated cost, $7,285,000, of which $2,500,000 was budgeted in the 1964–65 fiscal year.

Widen the Bayshore Freeway (US 101) from six to eight lanes between 19th Avenue in San Mateo and Broadway in Burlingame, a distance of 4.8 miles, and improve signing and lighting. Estimated cost, $1,110,000.

Reconstruct and resurface Route 84 between Route 1 near San Gregorio and 2.5 miles easterly. Estimated cost, $100,000.

Rights-of-way on various state highway routes—$7,245,000 (including $5,775,000 on the Interstate 280 Freeway).

Santa Clara County

$5,725,000 to complete the financing of a previously budgeted project to construct Interstate 280 as a six-lane freeway between Mountain View-Stevens Creek Road in Los Altos and Magdalena Avenue, and as an eight-lane freeway between Magdalena Avenue and 0.5 mile north of Page Mill Road in Los Altos Hills, with interchanges at Magdalena and El Monte Avenues, and ramp connections to Page Mill Road, a distance of 7.3 miles. Estimated cost, $8,725,000, of which $3,000,000 was budgeted in the 1964–65 fiscal year.

Extend the six-lane Interstate 280 Freeway construction now in progress (between Saratoga Avenue and Stelling Road in Cupertino) another 1.9 miles westerly to 0.6 mile west of Foothill Boulevard (Mountain View-Stevens Creek Road), with interchanges at Route 85 and Foothill Boulevard, and twin bridges across Stevens Creek. (These projects, together with a previously budgeted freeway project from Foothill Boulevard to Page Mill Road, will provide a full freeway between the Interstate 680 Freeway at US 101 in San Jose and Los Altos Hills.) Estimated cost, $3,600,000, of which $1,600,000 will be budgeted in the 1966–67 fiscal year.

Landscape the Interstate 280 Freeway between 0.3 mile west of Saratoga Avenue in San Jose and 0.2 mile west of Route 85 (Saratoga-Sunnyvale Road) in Cupertino, a distance of 3.5 miles. Estimated cost, $300,000.

Construct a four-lane freeway on Route 237 between 0.1 mile west of Borregas Avenue and 0.5 mile east of Lawrence Station Road in Sunnyvale, a distance of 2 miles, with an interchange at Lawrence Station Road. Estimated cost, $2,905,000, of which the state will pay $2,655,000, and the city and county the balance.

Construct the San Antonio Street Overcrossing and the Story Road Interchange on US 101 to convert an expressway section to full freeway, and resurface portions of this route between 0.4 mile north of Coyote Creek Bridge and 0.2 mile north of San Antonio Street in San Jose. Estimated cost, $1,900,000.

Reconstruct the outer lanes and resurface he inner lanes of US 101 between Leavesley Road and I.O.O.F. Avenue in Gilroy, a dis- ance of 0.7 mile. Estimated cost, $120,000.

Install left-turn storage lanes and modify raffic signals on US 101 at 16 intersections etween Llagas Creek and the north city mit of Gilroy. Estimated cost, $110,000.

Widen Route 9 in Saratoga between Oak 'lace and the junction of Route 85 (Sara- oga-Sunnyvale Road), and Route 85 from he junction to 0.3 mile north of Harriman Avenue, from two to four lanes; and widen nd construct shoulders on the existing two- ane Route 85 highway between 0.3 mile orth of Harriman Avenue and 0.4 mile outh of Pierce Road; and widen this route rom two to four lanes between 0.4 mile outh of Pierce Road and 0.1 mile north of he Southern Pacific Railroad tracks, a total listance of 2.3 miles. Estimated cost, $706,000, f which the state will pay $581,000, and the ounty and city the balance.

Construct the Dana Street Overcrossing nd approaches on the Route 85 Freeway in nd near Mountain View. Estimated cost, 421,800, of which the state will pay $260,- 00, and the city the balance.

Reconstruct shoulders and resurface Route 52 (Pacheco Pass Highway) between 0.3 nile west and 1.4 miles east of Bloomfield Road east of Gilroy, a distance of 1.7 miles. Estimated cost, $160,000.

Rights-of-way on various state highway routes—$910,000.

Projects under the city and county urban extension construction program:

Widen two miles of Stevens Creek Boulevard between Saratoga-Sunnyvale Road and Lawrence Expressway in Santa Clara, Cupertino and San Jose urban area to six-lane, divided highway. Estimated cost, $700,000 (state's share, $350,000).

Widen 2.2 miles of Foothill Expressway between Arastradero Road and El Monte Avenue in San Jose urban area to four-lane, divided highway. Estimated cost, $680,000 (state's share, $340,000).

Widen 0.6 mile of Foothill Expressway between Permanente Creek and Grant Road in San Jose urban area to four-lane, divided highway. Estimated cost, $200,000 (state's share $100,000).

Santa Cruz County

Complete the Route 1 Freeway (Watsonville Bypass) between the Monterey county line and 0.2 mile northwest of Roache Road, with interchanges at Route 129, Harkins Slough Road and Route 152, a distance of 3.4 miles (grading is underway under previous financing); and extend Route 129 from 0.1 mile east of Main Street in Watsonville to a connection with the new freeway, a distance of 1.6 miles. Estimated cost, $3,000,000. (This project connects with one in Monterey County to pave the freeway bypass of Watsonville between the Santa Cruz-Monterey county line and 1.2 miles southerly. Grading and the construction of the Pajaro River Bridge are in progress. Estimated cost, $785,000.)

Reconstruct and resurface Route 1 between Green and Rigg Streets in Santa Cruz, a distance of 0.5 mile. Estimated cost, $110,000.

Rights-of-way on various state highway routes—$150,000.

Sonoma County

Reconstruct Route 1 and improve drainage between 10.9 and 12.5 miles north of Fort Ross. Estimated cost, $350,000.

Install underdrains on portions of Route 1 between 0.5 mile south of Stewart's Point and the Mendocino county line. Estimated cost, $90,000.

Relocate Route 116 as a two-lane conventional highway on improved alignment between 1.2 and 1.7 miles east of Austin Creek at Big Bend, northwest of Monte Rio. Estimated cost, $320,000.

Rights-of-way on various state highway routes—$290,000.

CENTRAL COAST COUNTIES PROJECTS

Monterey County

Construct a four-lane freeway on Route between 0.7 mile south of Castroville and he intersection with Route 156, and on Route 156 to 1.2 miles north of the city, a otal distance of 1.9 miles. The project ncludes construction of the Route 1/156 nterchange and an overhead across the Southern Pacific tracks. Estimated cost, $1,450,000.

Pave the four-lane Route 1 Freeway (Watsonville Bypass) between 1.2 miles outh of the Pajaro River (Santa Cruz county line) and the county line. (Grading and the construction of the Pajaro River Bridge are in progress.) Estimated cost, $785,000. (This project connects with one n Santa Cruz County to complete the freeway bypass of Watsonville between the Monterey County line and 0.2 mile northwest of Roache Road, a distance of 3.4 miles, with interchanges at Route 129, Harkins Slough Road and Route 152. Grading is now in progress; and extend Route 129 from 0.1 mile east of Main Street in Watsonville to a connection with the new freeway, a distance of 1.6 miles. Estimated cost, $3,000,000.)

Replace structurally inadequate bridges on Route 1 across Buck Creek, 10.6 miles north of Lucia, and across San Jose Creek, three miles south of Carmel. Estimated cost, $530,000.

Install retaining walls on portions of Route 1 between the San Luis Obispo county line and Kirk Creek, four miles south of Lucia. Estimated cost, $320,000.

Construct the four-lane Route 68 Freeway between 0.5 mile south of Reservation Road and 0.2 mile north of Foster Road, near the south city limits of Salinas, a distance of 1.9 miles, with an interchange at Spreckels Road. (The Salinas River Bridge is now under construction.) Estimated cost, $1,510,000.

Construct an additional northbound off-ramp on US 101 at Soledad. Estimated cost, $145,000.

Rights-of-way on various state highway routes—$1,125,000.

Projects under the city and county urban extension program:

Widen 0.8 mile of Lighthouse Avenue between Reeside Avenue and Washington Street in Monterey to six-lane, divided highway. Estimated cost, $380,000 (state's share, $190,000).

San Benito County

Construct a two-lane expressway on Route 180 between 2 miles south of Hollister and 0.4 mile north of Tres Pinos, a distance of 3.1 miles. Estimated cost, $630,000.

Rights-of-way on various state highway routes, $285,000.

San Luis Obispo County

Construct interchanges on US 101 at Del Rio Road, San Ramon Road, Vineyard Road and Las Tablas Road to complete expressway-to-freeway conversion between Atascadero and Paso Robles. Estimated cost, $1,670,000.

Add two lanes to Route 1 between the Main Gate of Camp Luis Obispo and 0.4 mile north of San Luisito Creek, a distance of 4.4 miles, to complete a four-lane expressway between San Luis Obispo and Morro Bay. Estimated cost, $850,000.

Rights-of-way on various state highway routes—$300,000.

Santa Barbara County

Construct a two-lane expressway on Route 1 between US 101 at Las Cruces and San Julian Ranch, a distance of 8.8 miles, and add a northbound truck climbing lane near Las Cruces. Estimated cost, $5,000,000.

Reconstruct US 101 between Gaviota and 1 mile north of Nojoqui Summit, a distance of 7.1 miles. Estimated cost, $500,000.

Landscape US 101 between De La Vina and Pueblo Streets in Santa Barbara, a distance of 3 miles. Estimated cost, $300,000.

Relocate ramps and frontage roads to improve the interchange between US 101 and Route 154 (Hollister Wye) at the north city limits of Santa Barbara. Estimated cost, $190,000.

Rights-of-way on various state highway routes—$300,000.

Ventura County

Construct six lanes of the Route 118 Freeway from Kuehner Drive in Simi Valley, Ventura County, through Santa Susana Pass to Route 27 (Topanga Canyon Boulevard), a distance of 3.9 miles; and grade an additional 0.7 mile eastward to Variel Avenue in Chatsworth, Los Angeles County; and extend Route 27 1.5 miles north from Devonshire Street to this freeway. The project includes construction of partial interchanges at Kuehner Drive, Los Angeles Avenue (the summit of Santa Susana Pass), and Route 27. Estimated cost, $9,500,000.

Widen Los Angeles Avenue (Route 118) from two to four lanes and install traffic

signals and lighting at 3 intersections and channelization at 13 intersections between Tierra Rejada Road in Simi and Katherine Road, 8.7 miles easterly. Estimated cost, $1,100,000, of which the state will pay $1,035,000 and the county the balance.

Extend the four-lane Route 33 Freeway another 2.9 miles northerly to 0.4 mile north of Casitas Pass Road, with interchanges at Canada Larga Road and Casitas Pass Road (Route 150), and an overhead crossing of the Southern Pacific Railroad tracks, 0.4 mile south of Bounds Road, west of Ojai. Estimated cost, $2,800,000.

Construct the Wendy Road Interchange in Newbury Park and the Arneill Road Interchange in Camarillo as part of a continuing program to convert the four-lane US 101 (Ventura) Freeway from expressway to full freeway standards. Estimated cost, $1,380,000.

Construct a westbound off-ramp from the US 101 (Ventura) Freeway to Borchard Road in Newbury Park, relocate a frontage road and install a drainage facility to provide additional traffic capacity at this interchange. Estimated cost, $250,000.

Complete construction of the Victoria Avenue Interchange on the Route 126 Freeway, approximately 2 miles west of Saticoy. Estimated cost, $275,000.

Install and modify traffic signals and lighting and construct channelization at six intersections on Oxnard Boulevard (Route 1) between 0.2 mile south of Date Street and 0.1 mile north of Roderick Avenue in Oxnard. Estimated cost, $80,000, of which the state will pay $50,000 and the city the balance.

Rights-of-way on various state highway routes—$5,033,000 (including $2,700,000 on the Route 23 Freeway in the Thousand Oaks-Simi area).

SAN JOAQUIN VALLEY AND CENTRAL MOUNTAIN COUNTIES PROJECTS

Alpine County

Extend two-lane expressway construction now in progress on Route 4 (Ebbetts Pass Highway), between Ganns Meadow and Tamarack easterly to 0.6 mile east of the Calaveras-Alpine county line, a distance of 2.7 miles. Estimated cost, $820,000.

Rights-of-way on various state highway routes—$15,000.

Amador County

Reconstruct Route 124 as a two-lane expressway between Preston Avenue in Ione and 2.6 miles northerly, connecting to construction now in progress to Route 16 near Central House. Estimated cost, $700,000.

Rights-of-way on various state highway routes—$35,000.

Calaveras County

Extend two-lane expressway construction now in progress on Route 4 (Ebbetts Pass Highway), between Ganns Meadow and Tamarack easterly to 0.6 mile east of the Calaveras-Alpine county line, a distance of 2.7 miles. Estimated cost, $820,000. Project repeated above in Alpine County.

Add truck climbing lanes on 1.2 miles of Route 12 between 0.9 mile and 2.1 miles east of its junction with Route 26, approximately 2.5 miles west of San Andreas. Estimated cost, $115,000.

Rights-of-way on various state highway routes—$25,000.

Fresno County

Grade for the future four-lane Interstate 5 (Westside) Freeway between 0.3 mile west of Manning Avenue, west of Fowler, and the Merced county line, a distance of 20.7 miles, with interchange structures at Manning Avenue, Panoche Road, Russell Avenue, Shields Avenue - Little Panoche Road and Ness Avenue, and a bridge across Panoche Creek. Estimated cost, $4,950,000, of which $950,000 will be budgeted in the 1966-67 fiscal year.

Reconstruct and widen Route 33 between Route 180 in Mendota and Outside Canal, one mile south of Firebaugh, a distance of 6.3 miles. Estimated cost, $650,000.

Construct new on- and off-ramp connections from the US 99 Freeway to Fresno, Tuolumne and Stanislaus Streets in Fresno, and one-way distributor roads between Stanislaus and Fresno Streets. Estimated cost, $445,000.

Landscape US 99 between 0.2 mile southeast of Church Avenue and Kern Street in Fresno, a distance of 1.5 miles. Estimated cost, $200,000.

Plant trees along US 99 and oleander bushes in the median between 0.2 mile southeast of Church Avenue, south of Fresno, and the Kings River in Tulare County, a distance of 20.2 miles. Estimated cost, $124,000.

$65,000 as the state's share of the cost of installing channelization and modifying traffic signals at the intersection of Shaw and Clovis Avenues (Route 168) in Clovis. The county will perform this work as part of a major improvement of Clovis Avenue between California and Shaw Avenues.

Rights-of-way on various state highway routes—$1,570,000.

Inyo County

Construct a two-lane expressway on US 395 between 0.5 mile south of Coloseum Road, approximately 5 miles north of Independence, and Black Rock, just north of Aberdeen, a distance of 10.9 miles. Estimated cost, $1,300,000.

Rights-of-way on various state highway routes—$45,000.

Kern County

Grade for the future four-lane Interstate 5 (Westside) Freeway between US 99 at Wheeler Ridge and 0.1 mile north of Taft Highway (Route 119), a distance of 24.1 miles, with interchange structures at US 99, Route 166, Copus Road, Old River Road, Bear Mountain Boulevard and Taft Highway. Estimated cost, $5,720,000.

$350,000 to continue landscaping and screen planting in progress on US 99 between 0.2 mile south of Planz Road and Minkler Spur, in and near Bakersfield, a distance of 5.9 miles.

Construct a truck weighing station for eastbound traffic on Route 58, approximately one mile east of the junction with Route 223 (Bear Mountain Boulevard), south of Caliente. Estimated cost, $139,000.

Widen and surface Route 155 (Greenhorn Mountain Road) between 0.6 mile and 5.8 miles east of Woody, completing improvement of this highway between Woody and Alta Sierra. Estimated cost, $50,000.

Rights-of-way on various state highway routes—$4,200,000.

Projects under the city and county urban extension program:

Widen one mile of South 11 Street between Brundage Lane and Ming Avenue in Bakersfield to four-lane, divided highway. Estimated cost, $350,000 (state's share, $175,000).

Kings County

Extend Route 198 freeway construction now in progress (between Route 41 and 11th Avenue in Hanford) another four miles easterly as a freeway and expressway with interchanges at 11th Avenue, Douty Street, 10th Avenue and Central Valley Highway (Route 43). Estimated cost, $2,500,000.

Rights-of-way on various state highway routes—$569,000.

Madera County

Construct an interchange at Avenue 12 and an overcrossing at Avenue 13 to complete the conversion of US 99 from expressway to freeway between the Fresno-Madera county line and Madera, and resurface portions of this route between the county line and 0.2 mile north of Avenue 13½, south of Madera. Estimated cost, $1,910,000.

Rights-of-way on various state highway routes—$379,000.

Mariposa County

Improve a curve on Route 140, about six miles east of the Merced county line. Estimated cost, $124,000.

Rights-of-way on various state highway routes—$75,000.

Merced County

Extend the four-lane Interstate 5 (Westside) Freeway construction now in progress (between Route 152, west of Los Banos, and 2.8 miles north of Route 33, southwest of Gustine in Merced County) another 36.4 miles north through Stanislaus and southern San Joaquin Counties to its junction with Interstate 580; and construct the four-lane Interstate 580 Freeway for 5.2 miles, northwesterly from the junction to projects under construction or budgeted to one mile west

the San Joaquin-Alameda county line, bout seven miles west of Tracy. The proj-ct involves construction of interchanges at ullivan, Stuhr, Fink-Ward, Del Puerto anyon, Ingram Creek and Chrisman roads, nd bridges across the Delta Mendota anal; 10 creeks, and the California Aque-uct. Roadside safety rests will be provided n each side of the freeway just south of ne Stanislaus-San Joaquin county line. A sta point will be constructed for south-ound traffic approximately 1.5 miles south f Orestimba Creek and for northbound affic at Salado Creek in Stanislaus County. stimated cost, $23,345,000, of which $4,410,-00 will be budgeted in the 1966–67 fiscal ear. The State Department of Water Re-ources will contribute $195,000 to the over-ll cost. (Also listed in Stanislaus and San aquin Counties.)

Widen the Route 152 Expressway (Pa-heco Pass Highway) from two to four nes between Route 207, 8 miles west of os Banos, and 1.9 miles westerly. This roject connects to expressway construc-on in progress around the site of the uture San Luis Reservoir. Estimated cost, 685,000.

Widen Route 152 (Pacheco Pass High-ay) in Los Banos from two to four lanes etween Mercy Springs Road and 0.1 mile ast of Ward Road, a distance of 1.1 miles. stimated cost, $340,000.

Replace the structurally inadequate Boris nd Ex overflow bridges and reconstruct pproaches on Route 152 (Pacheco Pass Highway), approximately five miles east of he Don Palos Wye. Estimated cost, 150,000.

Landscape and install trees and functional lanting on the recently completed US 99 reeway between 0.9 mile south of Merced nd Black Rascal Creek, 1.5 miles north f the city, a distance of 4.6 miles. Esti-ated cost, $400,000.

Construct a pedestrian overcrossing on he US 99 Expressway at El Capitan Way in Delhi. Estimated cost, $110,000.

Widen portions of South Avenue, Sixth Avenue and Fourth Street (Route 33) in Gustine from 24 to 43 feet. Estimated cost, 210,000.

Rights-of-way on various state highway outes—$310,000.

Mono County

Extend two-lane expressway construction ow in progress on Route 120 (Tioga Pass Road) 4.1 miles easterly to 2.7 miles west f Lee Vining. Estimated cost, $3,800,000.

Rights-of-way on various state highway outes—$250,000.

San Joaquin County

Extend the four-lane Interstate 5 (West-ide) Freeway construction now in progress between Route 152, west of Los Banos, nd 2.8 miles north of Route 33, southwest f Gustine in Merced County) another 36.4 niles north through Stanislaus and southern San Joaquin Counties to its junction with nterstate 580; and construct the four-lane nterstate 580 Freeway for 5.2 miles, north-westerly from the junction to projects under construction or budgeted to one mile west of the San Joaquin-Alameda county line, about seven miles west of Tracy. The project involves construction of interchanges at Sullivan, Stuhr, Fink-Ward, Del Puerto Canyon, Ingram Creek and Chrisman roads, and bridges across the Delta Mendota Canal; 10 creeks, and the California Aqueduct. Roadside safety rests will be provided on each side of the freeway just south of the Stanislaus-San Joaquin county line. A vista point will be constructed for southbound traffic approximately 1.5 miles south of Orestimba Creek and for northbound traffic at Salado Creek in Stanislaus County. Estimated cost, $23,345,000, of which $4,410,000 will be budgeted in the 1966–67 fiscal year. The State Department of Water Resources will contribute $195,000 to the overall cost. (Also listed in Merced and Stanislaus Counties.)

Construct paired bridges and approaches for the Interstate 5 (Westside) Freeway across Smith's Canal, the Calaveras River and Fourteen Mile Slough, in and near Stockton. The first pair will carry eight lanes of traffic, and the second and third, six lanes. Estimated cost, $2,500,000.

Construct two-lane paired bridges on the Interstate 5 (Westside) Freeway across the California Aqueduct, two miles north of the Stanislaus county line. Estimated cost, $333,000, of which the state highway budget will provide $190,000, and the State Department of Water Resources the balance.

Extend Route 132 five miles westerly from its present terminus in Vernalis as an initial two-lane expressway of an ultimate four-lane freeway, and another one mile westerly as a four-lane freeway, to connect with the Interstate 580 (Westside) Freeway construction now in progress. The project involves construction of a crossing over the existing Route 33 highway and the Southern Pacific Railroad tracks in Vernalis, paired bridges across the California Aqueduct, and an interchange with Chrisman Road. Estimated cost, $3,510,000, of which the state highway budget will provide $3,360,000, and the State Department of Water Resources the balance.

Convert the four-lane US 99 Expressway to a six-lane freeway between the Stanislaus county line and 0.2 mile north of Ripon, a distance of 2.2 miles. The project involves construction of the Main Street Interchange and a pedestrian overcrossing at Acacia Avenue in Ripon, and widening the southbound bridge across the Stanislaus River from two to three lanes. Estimated cost, $2,330,000.

Widen the southbound lanes of the US 99 Freeway between the French Camp Road and Weber Road interchanges, and the northbound lanes between the Weber Road and Mariposa Road interchanges, just south of Stockton, a distance of 4.9 miles, and construct shoulders. Estimated cost, $315,000.

Construct the East Fourth Street Overcrossing and a connecting road to Golden Gate Avenue at Charter Way (Route 26) in Stockton to eliminate the Section Avenue intersection and convert a 0.6-mile expressway section of US 99 to full freeway. Estimated cost, $210,000.

Install functional and tree planting on the recently completed US 99 Freeway bypass of Lodi, between Armstrong Road and the Mokelumne River, a distance of 4.2 miles. Estimated cost, $200,000.

Reconstruct portions of US 50 between 1.1 miles west of Tracy and Kasson Road, 3.5 miles east of that city, a distance of 6.8 miles. Estimated cost, $250,000.

Rights-of-way on various state highway routes—$4,570,000 (including $3,500,000 on the Interstate 5 Freeway in the Stockton area).

Projects under the city and county urban extension program:

Construct parallel bridges for four-lane, divided highway on West Lane across the Calaveras River north of Stockton. Estimated cost, $350,000 (state's share, $175,000).

Widen 0.3-mile section of west lane south of the Calaveras River in Stockton to four-lane, divided highway. Estimated cost, $143,000 (state's share, $71,500).

Solano County

Install functional planting and trees on the Interstate 80 Freeway between 0.5 mile west of Vacaville and just west of the east city limit, a distance of 4.4 miles, and between Sweeney Creek, approximately 4 miles west of Dixon, and 1.2 miles northeast of Route 113 southwest of Davis, a distance of 6.5 miles. Estimated cost, $170,000.

Rights-of-way on various state highway routes—$35,000.

Stanislaus County

Extend the four-lane Interstate 5 (Westside) Freeway construction now in progress (between Route 152, west of Los Banos, and 2.8 miles north of Route 33, southwest of Gustine in Merced County) another 36.4 miles north through Stanislaus and southern San Joaquin Counties to its junction with Interstate 580; and construct the four-lane Interstate 580 Freeway for 5.2 miles, northwesterly from the junction to projects under construction or budgeted to one mile west of the San Joaquin-Alameda county line, about seven miles west of Tracy. The project involves construction of interchanges at Sullivan, Stuhr, Fink-Ward, Del Puerto Canyon, Ingram Creek and Chrisman roads, and bridges across the Delta Mendota Canal, 10 creeks, and the California Aqueduct. Roadside safety rests will be provided on each side of the freeway just south of the Stanislaus-San Joaquin county line. A vista point will be constructed for southbound traffic approximately 1.5 miles south of Orestimba Creek and for northbound traffic at Salado Creek in Stanislaus County. Estimated cost, $23,345,000, of which $4,410,000 will be budgeted in the 1966–67 fiscal year. The State Department of Water Resources will contribute $195,000 to the overall cost. (Also listed in Merced and San Joaquin Counties.)

Rights-of-way on various state highway routes—$455,000.

Tulare County

Complete the four-lane Route 198 Freeway construction now in progress between Ben Maddox Way and Road 164, and four-lane expressway construction between Road 164 and 0.3 mile east of Route 69, east of Visalia, a total distance of 9.4 miles, with interchanges at Lovers Lane and Roads 156 and 164. Estimated cost, $2,138,000.

Plant trees along US 99 and oleander bushes in the median between 0.2 mile southeast of Church Avenue, south of Fresno, and the Kings River in Tulare County, a distance of 20.2 miles. Estimated cost, $124,000.

Rights-of-way on various state highway routes—$100,000.

Tuolumne County

Rights-of-way on various state highway routes—$55,000.

RIVERSIDE–SAN BERNARDINO COUNTIES PROJECTS

Riverside County

Construct the four-lane Interstate 10 Freeway between 1.2 miles east of Desert Center and 1.3 miles west of Wiley Wells Road, about 18 miles west of Blythe, a distance of 27.4 miles. Estimated cost, $9,200,000, of which $4,200,000 will be budgeted in the 1966-67 fiscal year.

Construct the Palm Drive Interchange on Interstate 10, about two miles east of Garnet, to convert this route from expressway to freeway between Garnet and the future Date Palm-Vista Chino Interchange, a distance of 5.5 miles. Estimated cost, $470,000.

Construct an additional lane for westbound traffic on Interstate 10 between 22nd Street and the east city limit of Banning, a distance of 3.3 miles. Estimated cost, $435,000.

Construct decking between paralleling roadway bridges at four locations on the Interstate 10 Freeway, approximately eight miles west of Thousand Palms, to reduce maintenance costs caused by blown sand accumulation in creek channels. Estimated cost, $120,000.

Construct sanitary facilities and picnic tables at the roadside rests on the Interstate 10 Freeway, one mile northwest of Calimesa and three miles northwest of Beaumont, and on the Interstate 15 Freeway four miles east of Field. Estimated cost, $80,000. (Also listed in San Bernardino County.)

Construct a four-lane freeway on Route 71 between 0.7 mile north of Glen Ivy Road and Ontario Avenue in Corona, a distance of 5.5 miles, with interchanges at Weirick Road, Cajalco Road and El Cerrito Road. Estimated cost, $3,500,000.

Widen the US 395 Expressway from two to four lanes between 0.5 mile south of Grand Avenue near Sun City and Route 74 south of Perris, and construct an interchange at Grand Avenue. Estimated cost, $1,500,000.

Widen San Jacinto Street (Route 79) from two to four lanes between Florida Avenue (Route 74) in Hemet and Main Street in San Jacinto, a distance of 2.5 miles. Estimated cost, $160,000.

Landscape the Route 91 (Riverside) Freeway between Lincoln Avenue and the east city limit of Corona, a distance of 1.7 miles. Estimated cost, $150,000.

Widen the Adams Street Overcrossing on the Route 91 (Riverside) Freeway in Riverside from two to four lanes. Estimated cost, $120,000.

Install traffic signals on Hamner Avenue (Route 31) at Fifth Street and at Norco Drive in Norco, and at the ramp connections to the Interstate 10 (San Bernardino) Freeway from Euclid Avenue (Route 83) in Ontario and Upland. Estimated cost, $75,000, of which the state will pay $60,000, and Riverside County the balance.

Rights-of-way on various state highway routes—$2,705,000.

San Bernardino County

Construct a four-lane freeway on Interstate 40 between 2.5 miles east of Daggett and 8.5 miles west of Ludlow, a distance of 31.8 miles, with interchanges at Airport Road, the existing highway at Newberry, Fort Cady Road and Hector Road; and overhead across the A.T. & S.F. Railroad tracks, about 10 miles west of Ludlow; and 10 bridges across washes. Estimated cost, $12,300,000, of which $5,300,000 will be budgeted in the 1966–67 fiscal year.

Construct a four-lane freeway on Interstate 40 between 0.5 mile east of Java and the north city limit of Needles, and two additional lanes for westbound traffic to provide a four-lane freeway between the south city limit of Needles and three miles west of the Colorado River, a total distance of 12.8 miles, with interchanges at River Road Cutoff and National Old Trails Road, and 15 bridges across washes. Estimated cost, $5,110,000, of which $500,000 will be budgeted in the 1966–67 fiscal year.

Widen the Interstate 10 (San Bernardino) Freeway from four to eight lanes between Valley Boulevard, southwest of Fontana, and Pepper Avenue near Colton, a distance of 9.4 miles. The project involves major revision of the Cedar Avenue interchange and construction of an overhead across the Southern Pacific Railroad tracks at Cedar Avenue in Bloomington. Estimated cost, $4,000,000, of which the state will pay $3,400,000, and the county the balance.

$2,250,000 to complete the financing of a previously budgeted widening of the Interstate 10 (San Bernardino) Freeway from four to eight lanes between Valley Boulevard and Vineyard Avenue in Ontario, a distance of six miles. Estimated cost, $4,750,000, of which $2,500,000 was budgeted in the 1964–65 fiscal year.

Construct a four-lane freeway on Route 18 through Waterman Canyon in the San Bernardino Mountains, between 2.5 and 4.5 miles north of the city limit of San Bernardino. Estimated cost, $1,575,000.

Widen one mile of Route 62 to four lanes to permit passing on a steep grade, about 1.5 miles west of Yucca Valley; and eliminate six dips between Morongo and Yucca valleys. Estimated cost, $120,000.

Construct sanitary facilities and picnic tables at the roadside rests on the Interstate 10 Freeway, one mile northwest of Calimesa and three miles northwest of Beaumont, and on the Interstate 15 Freeway four miles east of Field. Estimated cost, $80,000. (Also listed in Riverside County.)

Rights-of-way on various state highway routes—$4,265,000.

LOS ANGELES REGION PROJECTS

Los Angeles County

Grade for the future eight-lane Interstate 5 Freeway between 6.8 miles north of Parker Road at Castaic and approximately 15 miles south of the Kern county line, a distance of 12.4 miles. Estimated cost, $36,500,000, of which $13,800,000 will be budgeted in the 1966–67 fiscal year.

Construct the eight-lane Interstate 5 Freeway between 6.8 miles south and 0.6 mile north of Route 138; and construct a four-lane freeway on Route 138, 2.1 miles easterly of Interstate 5. The project includes construction of interchanges with Quail Lake and Hungry Valley Roads and Route 138. Estimated cost, $9,400,000, of which $2,400,000 wil be budgeted in the 1966–67 fiscal year.

Add auxiliary lanes to the Interstate 5 (Golden State) Freeway between 0.1 mile north of Colorado Street in Los Angeles and 0.2 mile south of Western Avenue in Glendale; complete the interchange between the Interstate 5 (Golden State Freeway) and the Route 134 Freeway in Los Angeles; and construct the eight-lane Route 134 Freeway easterly from the interchange across the Los Angeles River to 0.2 mile east of San Fernando Road in Glendale. The project includes constructing an interchange between the Route 134 Freeway and San Fernando Road. Estimated cost, $7,500,000, of which $2,500,000 will be budgeted in the 1966–67 fiscal year.

Extend the eight-lane Interstate 5 Freeway construction now in progress (between Castaic Creek and 1 mile south of the Santa Clara River) 3.6 miles southerly to 4.1 miles north of Route 14, with interchanges at San Francisquito and Pico-Lyons Road. Estimated cost, $3,500,000.

Landscape the Interstate 5 (Golden State) Freeway between Peoria Street and San Fernando Road in Los Angeles, a net length of 8.2 miles. Estimated cost, $785,000.

Landscape the Interstate 5 (Santa Ana) eeway between the San Gabriel River and o Hondo in Downey. Estimated cost, 00,000.

Extend the eight-lane Route 60 (Pomona) eeway construction now in progress (be-een the East Los Angeles Interchange and oods Avenue), another 4.2 miles to Ar-yo Drive in South San Gabriel, connect-g with a previously budgeted project for miles easterly to Workman Mill Road; d extend this previously budgeted project miles easterly to Jellick Avenue just uth of Industry. Estimated cost, $15,185,-0.

Construct six lanes of the Route 118 Free-ay from Kuehner Drive in Simi Valley, entura County, through Santa Susana Pass Route 27 (Topanga Canyon Boulevard), distance of 3.9 miles; grade an additional mile eastward to Variel Avenue in Chats-orth, Los Angeles County; and extend oute 27 1.5 miles north from Devonshire reet to this freeway. Estimated cost, $9,-00,000.

Construct the eight-lane Route 90 Free-ay between Centinela Boulevard and Slau-n Avenue in Los Angeles, a distance of 1.5 iles, and complete its interchange with the terstate 405 (San Diego) Freeway. (Por-ons of the interchange were previously udgeted.) Estimated cost, $6,500,000, of hich $4,500,000 will be budgeted in the 966–67 fiscal year.

Grade and install structures for the future our-lane Antelope Valley Freeway (Route 4) between Avenue I, southwest of Lan-aster, and the Kern county line, a distance f eight miles. Estimated cost, $3,700,000.

Realign the Sierra Highway (Route 14) Palmdale, between 0.4 mile south and 0.1 ile north of Avenue R, to provide for a lanned railroad crossing and to improve he Avenue R intersection. Estimated cost, 50,000.

Widen the US 101 (Ventura) Freeway rom four to eight lanes for 3.5 miles be-ween the west city limit of Los Angeles nd Las Virgenes Road. Estimated cost, $2,-00,000.

Add two lanes in the median to widen the Route 7 (Long Beach) Freeway between Bandini Boulevard in Vernon and Olympic Boulevard in East Los Angeles, a distance f 1.4 miles. Estimated cost, $2,500,000.

Construct undercrossings at eight city treets in the route of the future Interstate 10 Freeway, between near Magnolia Ave-ue in Monrovia and Highland Avenue in Duarte, a distance of 2.4 miles. Estimated ost, $2,200,000.

Modify traffic signals and install lighting nd channelization at 13 intersections on Foothill Boulevard (Route 210) between Oro Vista Avenue and Tujunga Canyon Boulevard in Los Angeles. Estimated cost, 170,000, of which the state will pay $90,000, nd the city the balance.

Landscape the Interstate 405 (San Diego) Freeway between the Orange county line nd the Los Angeles River in Long Beach; nd between Artesia Boulevard in Torrance nd El Segundo Boulevard in Hawthorne, a net length of 10.9 miles. Estimated cost, $1,-160,000.

Regrade a slope on the Interstate 405 (San Diego) Freeway 1.5 miles north of Route 118 (Devonshire Boulevard) in the Mission Hills area to eliminate slides. Estimated cost, $75,000.

Grade for the future eight-lane Route 91 Freeway between 0.3 mile west of Normandie Avenue in Gardena and Vermont Avenue, just west of the Harbor Freeway, a distance of 0.9 mile. Estimated cost, $750,000.

Widen Artesia Boulevard (Route 91) from two to four lanes between Canehill Avenue in Bellflower and Gridley Road in Artesia, a distance of 1.2 miles, including widening the bridge across the San Gabriel River. Estimated cost, $300,000.

Widen Pacific Coast Highway (Route 1) from four to six lanes, and modify channelization and traffic signals at six intersections, between the San Gabriel River in Orange County and the Traffic Circle in Long Beach in Los Angeles County, a distance of 4.1 miles. Estimated cost, $800,000, of which the state will pay $780,000, and Long Beach the balance.

Modify traffic signals, improve drainage and widen the intersection of Lincoln Boulevard (Route 1), and Jefferson Boulevard, near Marina Del Rey. Estimated cost, $102,000, of which the state will pay $70,000, and the county the balance.

One hundred thousand dollars as the state's share of the cost of improving drainage at the intersection of Pacific Coast Highway (Route 1) and Sunset Boulevard in Los Angeles. The project, totaling $1,700,000, will be undertaken by the Los Angeles County Flood Control District.

Widen Norwalk Boulevard-Workman Mill Road (Route 605) from two to four lanes between El Rancho Drive and Strong Avenue, in and near Whittier, a distance of 0.8 mile. Estimated cost, $445,000.

Construct an overcrossing and approaches on the Interstate 605 Freeway at Wardlow Road in Long Beach. Estimated cost, $400,000.

Landscape the Interstate 10 (Santa Monica) Freeway and its interchange with the Interstate 405 (San Diego) Freeway between 0.3 mile west of Sawtelle Boulevard and Overland Avenue, and between 0.4 mile south of National Boulevard and Olympic Boulevard in Los Angeles, a net length of 2.7 miles. Estimated cost, $285,000.

Resurface portions of Olympic Boulevard (Route 10) between Centinela Boulevard in Santa Monica and Vermont Avenue in Los Angeles, prior to relinquishment to the cities of Santa Monica, Beverly Hills and Los Angeles. Estimated cost, $130,000.

Construct a pedestrian overcrossing on the Interstate 10 (San Bernardino) Freeway between City Terrace Drive and Whiteside Street, approximately one mile east of Soto Street in Los Angeles, across the freeway and the Pacific Electric Railway tracks. Estimated cost, $150,000, of which the state will pay $70,000, and the county the balance.

Modify traffic signals, lighting and channelization at 15 intersections on Lakewood Boulevard (Route 19) between Pacific Coast Highway (Route 1) in Long Beach and Alondra Boulevard in Bellflower. Estimated cost, $310,000, of which $240,000 will be paid by the state. The balance will be shared by the Cities of Long Beach, Lakewood and Bellflower.

Pave the medians of the Interstate 5 (Golden State) Freeway between Lanark Street and Osborne Street in Los Angeles; the Harbor Freeway (Route 11) between the Pacific Coast Highway (Route 1) in Wilmington and 111th Place in Los Angeles; the Ventura Freeway (US 101) between 0.5 mile west of Balboa Boulevard and 0.2 mile east of Lindley Avenue in the San Fernando Valley; and the Ventura Freeway (Route 134) between the Hollywood Freeway (US 101) in North Hollywood and the Interstate 5 (Golden State) Freeway in Los Angeles, a total distance of 19 miles. Estimated cost, $175,000.

Resurface and improve gutters on Topanga Canyon Boulevard (Route 27) between Mulholland Drive and Avenue San Luis in Los Angeles, a distance of one mile. Estimated cost, $150,000.

Modify traffic signals and lighting at 12 intersections on Verdugo Road (Route 2) between York Boulevard in Los Angeles and Glendale Avenue in Glendale. Estimated cost, $148,000, of which the state will pay $86,000, and the two cities the balance.

Modify traffic signals and lighting at nine intersections on Colorado Street (Route 134) between Pacific Avenue and Chevy Chase Drive in Glendale. Estimated cost, $103,000, of which the state will pay $52,000, and Glendale the balance.

Resurface Linda Vista Avenue (Route 159) between Holly Street and the vicinity of the Route 210 Freeway in Pasadena, a distance of three miles. Estimated cost, $70,000.

Rights-of-way on various state highway routes—$55,169,000 (including $14,300,000 on the Interstate 210 Freeway in the Pasadena-Arcadia-Glendora area; $7,700,000 on the Route 2 (Glendale) Freeway in and near Glendale; and $3,550,000 on the Route 134 Freeway in the Glendale-Eagle Rock area).

Projects under the city and county urban extension program:

Widen 2.6 miles of Azusa Avenue between Francisquito Avenue and Amar Road in West Covina and in Los Angeles urban area to four-lane, divided highway. Estimated cost, $1,200,000 (state's share, $600,000).

Orange County

Construct the six-lane Route 22 (Garden Grove) Freeway between 0.3 mile east of Main Street in Orange and the Route 55 (Newport) Freeway, a distance of 1.9 miles. The project involves completing the interchange at Main Street and constructing interchanges at Glassell Street, Tustin Avenue and the Newport Freeway. Estimated cost, $4,400,000.

Landscape the Route 22 (Garden Grove) Freeway between Garden Grove Boulevard and Newland Street in Garden Grove, and between Devon Road in Santa Ana and 0.3

mile east of Main Street in Orange, a net length of 1.9 miles. Estimated cost, $315,000.

Four million dollars to complete the financing of the eight-lane Interstate 405 (San Diego) Freeway construction now in progress between 0.2 mile northwest of Beach Boulevard (Route 39) and 0.2 mile southeast of Brookhurst Avenue in Fountain Valley, with interchanges at Cannery Street-Warner Avenue and Brookhurst Avenue. Estimated cost, $7,500,000, of which $3,500,000 was budgeted in the 1964–65 fiscal year.

Construct the four-lane Route 240 Freeway, a noninterstate southerly extension of the Interstate 605 Freeway, 0.7 mile between the Interstate 405 (San Diego) and Route 22 (Garden Grove) freeways. The project involves constructing portions of the interchanges with the two freeways. Estimated cost, $3,000,000.

Widen Pacific Coast Highway (Route 1) from four to six lanes, and modify channelization and traffic signals at six intersections, between the San Gabriel River in Orange County and the Traffic Circle in Long Beach in Los Angeles County, a distance of 4.1 miles. Estimated cost, $800,000, of which the state will pay $780,000, and Long Beach the balance.

Replace the Anaheim Bay Bridge and approaches on Pacific Coast Highway (Route 1) southeast of Seal Beach to provide additional width and vertical clearance over the channel. Estimated cost, $647,000, of which the state will pay $156,000, and the county the balance.

Widen portions of the Pacific Coast Highway (Route 1) from a conventional four-lane facility to a four-lane divided highway, and modify traffic signals between Diamond Street and Viejo Street in Laguna Beach, a distance of 1.2 miles. Estimated cost, $140,000, of which the state will pay $95,000 and the city the balance.

Widen Imperial Highway (Route 42) from two to four lanes divided between Beach Boulevard in La Habra and 0.3 mile east of Harbor Boulevard in Fullerton, a distance of 2.2 miles. Estimated cost, $570,000, of which the state will pay $530,000, and the two cities the balance.

Modify traffic signals, lighting and channelization, improve drainage and reconstruct portions of Imperial Highway (Route 42) between Sievers Avenue and Orange Avenue in Brea, a distance of 0.3 mile. Estimated cost, $80,000.

Replace the left-hand southeastbound on-ramp from Stanton Avenue in Buena Park to the Interstate 5 (Santa Ana) Freeway with a right-hand on-ramp. Estimated cost, $250,000.

Widen South Main Street (Route 73) between 0.5 mile north of relocated MacArthur Boulevard and Warner Avenue in Santa Ana, a distance of 1.1 miles, from three to four lanes, and modify and install traffic signals at three intersections. Estimated cost, $190,000, of which the state will pay $175,000, and the city the balance.

Modify traffic signals, lighting and channelization at nine intersections on Beach Boulevard (Route 39) between Main Street-Ellis Avenue in Huntington Beach and La Palma Avenue in Buena Park. Estimated cost, $145,000, of which the state will pay $105,000.

Resurface and paint channelization lanes on Los Angeles Street (Route 72) between 0.1 mile south of Cerritos Avenue and 0.1 mile north of Ball Road in Anaheim, a distance of 0.7 mile. Estimated cost, $65,000.

Rights-of-way on various state highway routes—$14,652,000 (including $8,600,000 on the Interstate 405 (San Diego) Freeway, and $3,700,000 on the Route 57 Freeway between Santa Ana and the Los Angeles county line north of Brea.)

SAN DIEGO–IMPERIAL COUNTIES PROJECTS

Imperial County

Construct the four-lane Interstate 8 Freeway between 0.4 mile west of Imperial Avenue in El Centro and 0.4 mile east of Route 111, a distance of 4.8 miles, with interchanges at Imperial Avenue, Fourth Street, Dogwood Road and Route 111. Estimated cost, $6,100,000, of which $3,100,000 will be budgeted in the 1966–67 fiscal year.

Rights-of-way on various state highway routes—$1,287,000.

San Diego County

Extend the Interstate 5 (San Diego) Freeway 9.7 miles northerly as an eight-lane facility between 0.4 mile north of the San Luis Rey River at Oceanside and 2 miles north of Las Pulgas Road, approximately 12 miles south of San Clemente, with interchanges at Vandergrift Boulevard and Las Pulgas Road. Estimated cost, $9,600,000, of which $3,900,000 will be budgeted in the 1966–67 fiscal year.

$6,000,000 to complete the financing of a previously budgeted project which will extend the eight-lane Interstate 5 (San Diego) Freeway in San Diego 2.2 miles northerly to Rosecrans Street, with interchanges at Washington and Trias Streets; a viaduct crossing of the AT&SF railroad tracks, US 101 and Rosecrans Street; and temporary connections to US 101. Estimated cost, $9,000,000, of which $3,000,000 was budgeted in 1964–65 fiscal year.

Construct the eight-lane Interstate 5 (San Diego) Freeway between the San Diego River and 0.3 mile north of Tecolote Creek, a distance of 0.9 mile, with an interchange at Sunset Cliffs Boulevard. Estimated cost, $2,750,000.

Pave to complete the eight-lane Interstate 5 (San Diego) Freeway between 0.6 mile south of Carmel Valley Road and 0.4 mile north of Via de la Valle near Del Mar, a distance of 4.1 miles. Estimated cost, $2,200,000.

Extend a previously budgeted eight-lane construction project on the Interstate 5 (San Diego) Freeway (between San Marcos Road near Encinitas and 4.8 miles south of Route 78 in Oceanside) another 1.6 miles northerly, with an interchange at Palomar Airport Road. Estimated cost, $1,200,000.

Landscape and install functional planting on the Interstate 5 (San Diego) Freeway between 28th and Market Streets in San Diego, a distance of 1.5 miles. Estimated cost, $360,000.

Add one southbound lane on the Interstate 5 (Montgomery) Freeway between 0.4 mile south of H Street in Chula Vista and 0.1 mile south of 24th Street in National City, a distance of 2.4 miles, pending future widening of this section to eight lanes. Estimated cost, $216,000.

Extend the soon-to-be-completed four-lane Interstate 8 Freeway section in the Mountain Springs area, near the Imperial-San Diego county line, another 10 miles westerly to County Road J-35 near Boulevard, with interchanges at Carrizo Gorge Road near Jacumba, and at Inkopah County Park at the county line. Estimated cost, $8,562,000, of which $4,562,000 will be budgeted in the 1966-67 fiscal year.

Extend the four-lane US 395 Freeway construction now in progress (between 2 miles north of Miramar Road at the Miramar Naval Air Station and north of Poway Road) another 5.2 miles northerly to 0.6 mile north of Rancho Bernardo Road, with interchanges at Carmel Mountain Road and Rancho Bernardo Road. Estimated cost, $3,580,000.

Construct an interchange between the Route 78 Freeway and El Camino Real at the city limits of Oceanside and Carlsbad. Estimated cost, $1,150,000.

Construct a frontage road for the future Route 67 Freeway between Pepper Drive and Broadway in El Cajon, and portions of interchanges with Bradley Avenue and Fletcher Parkway-Broadway. Estimated cost, $1,000,000.

Grade and construct an undercrossing for the future Route 94 Freeway between 0.2 mile east of Palm Avenue and Conrad Drive near La Mesa, a distance of 1.4 miles. Estimated cost, $900,000.

Widen Route 76 from two to four lanes between 0.8 mile and 2.4 miles east of Interstate 5 in Oceanside, pending future freeway construction of this route on new alignment. Estimated cost, $400,000.

Rights-of-way on various state highway routes—$12,907,000 (including $6,800,000 on Interstate 805 in the San Diego area).

Projects under the city and county urban extension program:

Widen 2.3 miles of Broadway between Magnolia Avenue and East Main Street in El Cajon to four-lane highway. Estimated cost, $1,015,000 (state's share, $376,000).

Letter of Transmittal

December 2, 1964

MR. JOHN ERRECA
Director of Public Works
State of California

Dear Sir:

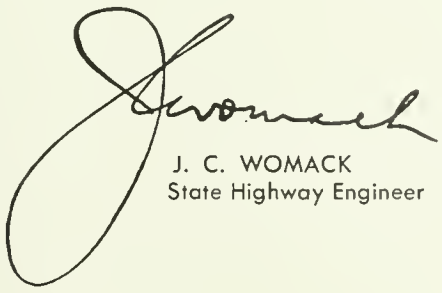
The 18th Annual Report of the Division of Highways for the fiscal year ending June 30, 1964, is submitted herewith for your approval and transmittal to Governor Edmund G. Brown. It was prepared in compliance with Section 143 of the Streets and Highways Code.

The report updates information on the statewide construction program through the end of this calendar year and describes projects in the 1965–66 fiscal year budget, adopted by the Highway Commission at its October meeting.

Construction emphasis again was focused on California's 2,178-mile share of the national system of defense and interstate highways, a system within and comprising approximately 17.5 percent of the state's 12,414-mile freeway and expressway system. This emphasis will be continued over the next several years to meet the federal requirement that it be completed by 1972.

Attention to the interstate system, however, has not prevented the division from making good progress in converting noninterstate routes to freeway standards, or in improving traffic safety and mobility by widening conventional highways, easing curves and installing left-turn lanes.

The text portion of the annual report is illustrated and published as the November–December issue of our bimonthly magazine, *California Highways and Public Works*. A supplement containing financial statements, apportionment tables, contract statistics and other data will be available to interested persons on request.



J. C. WOMACK
State Highway Engineer

December 2, 1964

EDMUND G. BROWN
Governor of California

My dear Governor:

California's continuing progress in improving traffic safety and mobility is described in the 18th Annual Report of the Division of Highways, Department of Public Works, which I am pleased to submit to you. The report also covers the activities of the division's various units for the fiscal year ending June 30, 1964.

I am particularly pleased to report that the state's 1,500th mile of full freeway, included in an Interstate 15 project in San Bernardino County, was opened to traffic in October. Completed freeway mileage will increase to 1,589 by the end of this year.

To mention only a few of the notable freeway openings during 1964, there were the Donner Summit section of Interstate 80; several projects on heavily traveled freeway routes in the Los Angeles metropolitan area; and several projects on US 99, US 101 and Interstate 5 in the northern areas of the state.

Steady progress is also being made in extending freeway mileage in the San Diego area and a good start has been made on the Interstate network in Sacramento.

Also, while the records clearly show that construction of modern freeways is the single greatest advance we can make in the cause of traffic safety, we are conducting intensified research into methods of making existing highways safer through engineering improvements.

Routings have been adopted by the Highway Commission for all but 18 miles of California's share of the national system of defense and interstate highways; 701 miles of this system have been completed, and another 527 miles are under construction or budgeted. Additionally, 169 miles are in operation as expressways but will be upgraded to full freeway standards by 1972.

Most of this completed mileage has been in densely populated metropolitan areas and in the mountains and deserts, thereby affording the greatest traffic relief. A great portion of the remaining mileage will be constructed in relatively easy rural terrain.

Despite firm predictions that motor vehicle travel in California will increase to 200 billion miles a year by 1980, the state's orderly program of freeway construction and other highway development will insure less traffic congestion at that time than exists today.

Respectfully,

JOHN ERRECA
Director of Public Works

California Highways and Public Works
DIVISION OF HIGHWAYS
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JANUARY–FEBRUARY
1965

In drumming rain, beneath low-hanging clouds, public utility crews labor at restoring electrical power in flood-stricken Humboldt County on Christmas Day, 1964. Photo was made on US 101 between Alton and Fortuna, where rampant Eel River cut new channel and tore up the highway. See flood articles beginning on page 2. (Photo courtesy of *Humboldt Beacon, Fortuna.*)

California Highways and Public Works

Official Journal of the Division of Highways, Department of Public Works, State of California

Vol. 44 January–February Nos. 1–2

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WILLIAM R. CHANEY, *Chief Photographer*

Editors are invited to use information contained herein and to request prints of any black and white photographs.

Address communications to: EDITOR,

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

P.O. Box 1499

SACRAMENTO, CALIFORNIA 95807

FRONT COVER: The first glimpse of the Pacific Ocean on US 101, after the motorist leaves the Golden Gate Bridge in the northerly direction, occurs 300 miles later on this new stretch of four-lane highway which bypasses McKinleyville. Here he is afforded unrestricted access to the magnificent beach for a distance of one and a half miles via frontage roads. The roadside rest features a wooden plaque dedicated to this area "Where the Majesty of the Redwoods Meets the Beauty of the Sea" and an exceptional view of Trindad Head. See "McKinleyville Freeway," page 31. Photo by Robert Mulno.

BACK COVER: The crisp redness of the firethorn berries brought a touch of color to the US 99 freeway at Tulare during the holiday season. See "12,000 Shrubs and Trees," inside back cover. Photo by Bill F. Ruland.)

CHRISTMAS FLOODS 1964

PART 1: *The Redwood Highway*

By JOHN ROBINSON

Robinson Ferry (Paul Mudgett Memorial) Bridge, on US 101, at height of Christmas, 1964, flood. Eel River overflow in foreground tore great gaps in the roadway, while debris piled behind center spans caused structure failure at main stream. Note houses in debris. Town in background is Ria Dell. Redwood Highway traffic is now using county "Blue Slide" road which travels along flat at upper right. Contract for repair at bridge is well underway, and bridge is expected to be back in service by about May 1. (Photo courtesy of Eureka Newspapers, Inc.)

In the northwestern sector of California, where winter storms sweep in from the Pacific and drop rainfall approaching rain forest conditions, the narrow valleys between the ridges of the Coast Range, running north and south parallel to the coastline, are a series of troughs which collect the water. One of area's most important rivers, the Eel, and its major tributary, the South Fork, flow northward 150 miles while only 30 miles or so from the coast. Running longitudinally through a strip subject to heavy rains, phenomenal rises and floodings are common to the river system, as would be expected.

Most of the north coast rivers follow this same pattern, except for the powerful Klamath, which cuts deeply through the Klamath Range, but the topography of its drainage is very similar to that of the Eel. Periodically, a series of fierce winter storms, spread over a broad area, drop heavy rains over the combined watersheds of these several rivers, and widespread flooding occurs.

Nine years ago, in December 1955, just before Christmas, such a series of storms struck the coast, and the resultant floods, particularly along the Eel, were the worst on record. There was considerable loss of life, and very heavy property damage.

History in the north coast counties of California seemed to be repeating itself in the last half of December 1964, when continuous rainfall saturated the Coast Range and the Klamath Mountains. Just as in the record floods of 1955, the rivers draining these ranges began to rise within their banks a few days before Christmas. Those who dwelt near the flood mark

paused in decorating their trees to listen with special attention to the weather forecasts on their radios.

On Monday, the 21st of December, a great mass of tropical air, supersaturated with water, was driven in from the Pacific over these northern ranges. The watersodden air, cooled rapidly as it was deflected upward by the mountains, dropped its load like liquid squeezed from a sponge. On the 21st and 22nd of December torrential rainfall approaching cloudburst proportions was common over most of the north coastal counties.

On the 22nd Garberville, on the South Fork of the Eel, recorded 8.29 inches. In the 1955 flood period its highest one-day fall was 3.23 inches. Grizzly Creek State Park on the Van Duzen River recorded 6.52 inches on the 22nd, against a record 4.43 inches in 1955. Klamath Glen recorded 4.02 on the 22nd and 4.01 on the 23rd. The report from this station noted that "the gauge is near the river mouth and does not reflect rainfall in the upper regions" (where it was much higher). Likewise, Jedediah Smith State Park, near the mouth of the Smith River, reported 4.08 inches, compared to a 1955 higher figure of 2.74.

Highest one-day fall on record in the area was at Richardson Grove, well up on the South Fork of the Eel, with 11.30 inches on the 22nd, and 7.23 on the 23rd. Still farther up the Eel drainage, Laytonville recorded 10.75 inches on the 21st, and 11.75 on the 22nd. The heavy December 21st rains here had already started downstream when the widespread downpours of the 22nd struck.

The water falling on the saturated ridges ran off almost as fast as it fell, and the resultant rise in the river canyons was frightening. On the 22nd all the major river systems of the north California coast were flooding heavily and still rising—primarily the Eel, but also the Van Duzen, the Mad, Redwood Creek, the Klamath-Trinity system, and the Smith.

In places, the rise was several feet an hour but actual recordings of water depths are spotty. Before the rivers crested many gauges were swept away or topped by the raging floods.

Eel River in full flood, site of town of Pepperwood in foreground. Highway 101 posses across photo about quarter of the way up. Town was destroyed, with many buildings caught in graves of trees amidst debris seen in picture. (Photo courtesy of Eureka Newspapers, Inc.)

ABOVE: Debris deposited by flood on US 101 in redwood graves just upstream from Pepperwood. Barn with cupolas came from site across river and several miles upstream. BELOW: Downstream bridge of pair on Redwood Highway at South Scotia was also flood victim. Older bridge at left of through-truss design, survived flood because it was high enough to avoid debris which collected on truss below deck of newer bridge now missing at right. (Photo courtesy of Eureka Newspapers, Inc.)

George Leatherwood Memorial Bridge, on US 101 Freeway near Dyerville on South Fork of Eel, withstood flood after blasting of debris by a highway maintenance man. Stubs visible just downstream are approaches to old through-truss bridge on Route 254, Avenue of the Giants. This bridge failed at height of flood, when water was somewhat higher, although it had stood through many previous floods. (Photo courtesy of Eureka Newspapers, Inc.)

ABOVE: Destroyed Northwestern Pacific Railroad Bridge at South Fork. One of the wrecked spans may be seen in foreground. BELOW: View of railroad right-of-way in main Eel canyon at Alderpoint, where river rose about 95 feet. Note earth deposited on tracks. (Photo courtesy of Northwestern Pacific Railroad.)

An observer at Alderpoint, on the main Eel River above its confluence with the South Fork, estimated a record crest between 95 and 105 feet. This was at least 15 feet above the Eel's highest crest here in 1955.

With the streams already running bank full, such a rise was inevitable. In the 36 hours of heaviest rainfall on the 21st and 22nd, the Eel drainage received additional precipitation about equal to dumping into it the 3½ million acre-feet of Shasta Reservoir when filled to capacity. As these torrents of water roared down the river, the people of Humboldt County began to realize they were experiencing the most disastrous flood on record—a "thousand-year flood," as one engineer called it.

Virtually every structure on the flats along the lower Eel Canyon was swept away, and in many cases residents escaped with little more than their lives and the clothes they wore. On some 20 miles of the lower South Fork, town after town was devastated. Upstream on the main Eel those towns that were located near the flood level also suffered heavily.

Below the junction of the two streams, the Towns of Holmes, Shively and Alton were virtualy wiped out. Pepperwood, a small town of about 400 people on US Highway 101, had only two or three ruined buildings left standing when the waters receded, and the townsite is now a debris-cluttered plain with the houses piled in a helter-skelter heap against a grove of trees downstream.

Although the rise at many points was 15 to 20 feet above the highest flood of record on the Eel, the loss of life was low, presumably because modern communications warned most people in time. Nevertheless, few saved any personal property, as none believed the crest would be so much higher than in 1955.

Actually, the amount of water flow was incredible for such relatively small river systems. Below Alton, the Eel is joined by the Van Duzen River, which crested simultaneously. At the height of the flood, stream velocity at this point is estimated to have approached one million cubic feet of water per second. This flow would fill Shasta Reservoir in two days, so the analogy used above, comparing the rainfall with dumping Shasta Reservoir into the river is not farfetched.

If a flow of around 900,000 cfs is accepted, this can be compared to the 1,100,000-cfs flow of the Columbia during the same floods in the northwest. The average flow of the Mississippi at Vicksburg, near its mouth, is less than 600,000 cfs, and even in its great floods is only about 3,000,000 cfs, so it can be said the Eel in flood was carrying almost a third of the amount of water the Mississippi does in its worst floods!

In this comparison, it should be noted the Mississippi has a vast area over which to spread, with a very gentle gradient. The flow in the Eel, traveling in a narrow canyon with a steeper gradient, was much faster, and hence more destructive. Houses were not gently lifted off their foundations

and floated away, they were tossed along almost as before a fire hose.

A complicating problem of this flood and its extraordinary rainfall was the tremendous amount of "drift." On the slopes above the rivers, broken tree branches, ancient windfalls, and partly uprooted stumps were loosened and carried down into the streams. This material, some of which had lain undisturbed for decades, moved into the center of the stream where it was carried along at 15 to 20 miles an hour.

Many lumber mills in the canyons had "cold decks," that is, their winter supply of logs, stacked close to the river bank, but at levels where they were believed safe from flooding. As the water rose, these logs, weighing up to 30 tons each, were picked up and carried out into the stream to become deadly missiles shooting along in the other debris.

At Pacific Lumber Company in Scotia, where a tract for the cold deck had been especially raised by filling to above the 1955 flood level, several thousand logs totaling 18,000,000 board feet were swept away. In addition, some 15,000,000 board feet of stored lumber went downstream, and railroad boxcars on a siding were tossed around like dice thrown from a cup. The flood losses of this company alone were about $8,000,000.

North of Eureka, in southern Del Norte County, the Klamath, always a strong, deep stream, rose rapidly and swept away the entire business section and many private homes in the town of Klamath and nearby communities. The beautiful old concrete arch bridge here, famous for its statues of California Bears on either end, was a casualty.

An eyewitness of the bridge's death told Sam Helwer, district engineer, that before the structure failed, debris was backed upstream several hundred feet, although the river level was still several feet from the top of the arches. At times small logs would come hurtling downstream, hit the floating debris, and shoot into the air completely over the structure. The pressure of the river against the debris finally pushed 400 feet of the bridge out of the way, and the debris shot downstream with a roar.

Altogether, District 1 lost 18 state highway bridges, 7 of these on the Redwood Highway, but the full extent of the loss was not clear until some days after the flood because of the disrupted communications. In many cases the bridges carried the utility lines, and when the bridges

ABOVE: Squaw Creek, cascading down the steep slopes at Cummings on the Redwood Highway, tore this gap in the road. BELOW: This concrete arch bridge on US 199 above Crescent City withstood the flood, despite obvious pounding. Note debris lodged in every opening, and battered conditions of railing.

ABOVE: North abutment of North Scotia Bridge at Rio Dell torn out by force of Eel, here shown partly in flood. Building at left of broken bridge end is now gone. (Photo courtesy of Eureka Newspapers, Inc.) BELOW: Looking south along US 101, the Redwood Highway, with the town of Klamath in the foreground, and washed-out bridge in background. (Photo courtesy of Eureka Newspapers, Inc.)

went out, electrical and telephone lines also were broken. In some places, the rushing water literally washed utility poles out of the ground.

Mostly by radio, the information trickled into district headquarters. The first reports came in on US 101, as much of the damage here was close to the settlements. Here, too, was the most serious bridge damage.

South of Fortuna, where the Eel begins to emerge from its canyon, the river makes a big reversed S, which the highway crosses like the bar in a $ sign, and each crossing of the river needs a big bridge.

At the first crossing just south of Fortuna, more than 600 feet was gone from the 1,613-foot Robinson Ferry Bridge. One large through-truss span, and 5¾ concrete approach spans were missing. This effectively stopped all traffic on US 101 south of Eureka.

Just beyond this bridge, within the curve of the bottom half of the Eel's reverse S, lies the flourishing town of Rio Dell, with US 101 its main street. Here at the south end of town, another bridge crosses the Eel, the North Scotia Bridge, giving access to Pacific Lumber Company's town of Scotia, and accommodates traffic heading south on the Redwood Highway.

At the Rio Dell end of this bridge, also a large through-truss structure, the river washed out 62½ feet, including the abutment. The river bed is narrow and deep here, and readings at Scotia indicate the flood may have reached its greatest velocity in this canyon.

After the wide swing around Scotia, this tremendous flow was concentrated against the Rio Dell side, and it cut deeply into the steep bluffs. Several houses and stores tumbled into the river, and the current tore out the bridge's northern anchorage, leaving an open gap.

Rio Dell was isolated. The only other entry is via a county route, the Blue Slide Road, which connects the town with Ferndale along the south side of the Eel. Several miles of this road which lay close to the river were gone completely, including the several feet of fill used for base, and the river was running over it many feet deep.

Across the Eel to the south lies Scotia, with Pacific Lumber Company bereft of all its stored logs, and a big portion of its inventory of lumber. Although there was some flooding of the road here, damage was negligible. A few miles farther on, at the top of the reverse S, a pair of bridges crossed the river, carrying northbound and southbound traffic on separate structures. The older structure, a through-truss type which stands upstream and carried the northbound lanes, survived the flood.

A new bridge, opened to traffic in the winter of 1960–61 and which carried the southbound lanes, was swept away. Although it stood higher than its companion, it was a deck truss type, its truss extending down below the deck 18 feet. Drift collecting in the steel truss finally created such a dam the bridge was pushed off its piers.

Beyond these bridges the road follows the south bank of the river for a few miles, including the portion through Pepperwood. On the sections close to the river, undercutting and slides were severe up to the point where the road veers away from the main canyon and starts up the South Fork.

At the southern end of the Avenue of the Giants—the old Redwood Highway which has been retained for tourists—the road crosses the South Fork. Here for many years stood an old fashioned through-truss steel bridge, and when the freeway was built it was retained as a connection from the main road into the avenue.

This fine old relic is gone, an early casualty to the flood. It stood much lower than the new freeway bridge, and no doubt its trusses collected great masses of debris before it gave way, for in this section of the canyon the water boiled through 20 feet deeper than ever before recorded.

Its younger companion upstream, a simple steel girder type, offered less resistance to the combination of debris and water, but nevertheless almost became a casualty also. At the height of the flood, when debris was piled against the structure in great depth, and the deck portion was actually visibly lifting and shifting on its supports,

Division of Highways maintenance man William F. Wilson, Jr., climbed out on the debris and at the risk of his life planted charges which broke up the jam and saved the bridge.

The freeway sections between Dyerville and Phillipsville, totaling 23.4 miles, withstood the flood well. In one place underground water filtered out some of the subgrade, allowing two lanes of the paving to drop several feet. At another place a culvert was plugged by debris and the resultant stream over the paving undercut the two outside lanes so that they dropped away. Near Dyerville and at one or two other points the river washed out the outer edge of the fill so that a total of several hundred yards of guardrail was lost.

At no time was the freeway closed to traffic, and such repairs as were necessary represented commitment of a small group of men and equipment for only a few days at the most. With such minor damage, despite the fact the river came over the paving many feet deep in places, the superiority of modern engineering and construction was demonstrated. Cut slopes showed little or no tendency to move, fills remained stable, there was no bridge damage, and, in general, drainage functioned perfectly.

On the old, obsolete sections between Phillipsville and Laytonville destruction was so severe it will take at least a year to complete repairs. Slides involving half a million yards of earth were not uncommon, and washouts cut great ravines across the highway. On the precipitous portions between Garberville and Leggett, where the road clings to a narrow ledge hundreds of feet above the river, undercutting eliminated at least half of the highway in many places, leaving a one-lane road with no outside shoulder, and two- and three-hundred-foot drops alongside.

Where the damage in the lower Eel mostly resulted from tremendous flows and heavy debris in the main stream, much of the damage in the upper canyon was caused by side water. The canyon walls are very steep here, and vegetation is sparse.

The amount of debris loosened by the pelting rains and washed down the

Logs from mills' storage and other debris carried down by rivers and washed into Crescent City harbor. Cut logs are worth about $100 apiece.

ABOVE: US 199 in the Smith River Canyon, the section of the Redwood Highway which connects Crescent City and Grants Pass, Oregon, is here seen completely washed away without vestige. (Photo courtesy of Six Rivers National Forest, U.S. Forest Service.) *BELOW: This photo at Weott gives an inkling of how high water was.* (Photo courtesy of Eureka Newspapers, Inc.)

Road destruction may be from several causes. This photo on US 101 in Mendocino County shows the effect of undercutting by a parallel stream.

ABOVE: In this photo of roadbed destruction on Northwestern Pacific Railroad debris washed down the slope has filled the culvert and the stream has cut a new bed. (Photo courtesy of Northwestern Pacific Railroad.) BELOW: Destruction here is by slipout, or, in other words, a slide of the supporting slope below the roadbed.

slopes was very heavy, and culverts and small bridges choked quickly. Tiny streams and normally dry gullies became raging torrents which the established drainage facilities could not accommodate, particularly since they rapidly clogged with debris. Water rushing across the roadway washed out fills and foundations, often "eating back" across the paving until there was sometimes a cut a hundred feet deep where the road had been.

In places the river cut away the toes of slopes hundreds of feet high, and the entire slope slumped, bringing long stretches of highway with it. In other places slopes above the road, sometimes rock, sometimes gravel, slid down to cover hundreds of feet of highway. Except for those located on the freeway, every town along the upper Eel was isolated from its neighbors. The freeway was isolated from Eureka by the damaged bridges.

North of Eureka most of the Redwood Highway is on high ground, or is modern expressway or freeway. Except for the destruction of the Klamath River Bridge, damage between Eureka and Crescent City was slight. Heavy flooding by Redwood Creek in Orick left a layer of silt several feet thick on the roadway, but this was quickly cleaned up.

But it was another story on US 199, which carried the Redwood Highway into Grants Pass, Oregon, via the Smith River Canyon. Above Gasquet, damage was severe. Three concrete arch bridges were carried away, and several miles of roadway lost. In places the roadway destruction here was so complete the canyon looked as though it had never had a road through it.

So extreme was the damage in this canyon, it was days before it could be assessed adequately. Crews were sent up through Oregon to begin working on the northern end of the damaged area, and others started working from the south. The only way the damage could be surveyed properly over the 20 miles or so of worst devastation was by sending young engineers in on foot to hike through with backpacks. In this canyon, and in many other places in Highway Districts 1 and 2, where road communications were completely destroyed, this meant miles of travel on foot through knee-deep mud, steep climbs high above the river through trackless forest to get around washouts, and sleeping and eating wherever local hospitality was available.

When the floods receded, the Redwood Highway was closed to all traffic in dozens of places. Damage to east-west routes connecting Humboldt County with the Sacramento Valley was equally severe. All highways in and out of the area were closed.

BELOW: This photo shows one of the few places where damage occurred on the Redwood Parks Freeway, resulting in the loss of two lanes. Culvert became plugged and stream went over pavement, "eating back" by washing out slope on outside.

Crescent City had a roundabout oute open north over 101 through regon. Eureka and the Humboldt wland were isolated, except by sea rough a debris-cluttered harbor, and air through small and often weather-losed airports, for the railroad was so hard hit.

The Northwestern Pacific had sus-ended service indefinitely. Its tracks own the Eel Canyon were deva-ated. When the flood subsided, rail-ad men found on a 100-mile stretch ore than 50 miles of track twisted nd uprooted, millions of yards of ock riprap washed away with fills one, three steel bridges destroyed, ver 70 pieces of rolling stock miss-ng, and debris and silt piled every-here the right-of-way was not de-royed. Cost of repairs was estimated t $10 million.

Since the Humboldt–Del Norte conomy is about 75 percent based on orest products, and since normally he railroad hauls about 75 percent f these products, this made the flood doubly severe blow at the region. Not only had the floods caused tre-nendous damage to property, but the egion's ability to recover was crip-led.

The value of modern transport was nce again demonstrated, for with the lestruction of its transportation, the rea's economy was brought to an mmediate halt, and many thousands f people were affected in addition to hose whose property was in the di-ect path of the flood. This put tre-nendous pressure on state highway ersonnel to reopen the roads as soon s possible, to alleviate in part the economic distress.

Although it is being said the storm was "one in a thousand years," there s no guarantee this is so. Certainly new records are now established which must be taken into account in future design, which means more ex-pensive construction. It should be kept in mind that both the 1955 and 1964 storms struck exactly on the winter solstice, when the northern hemisphere storm track is at its most southern point. The same set of cir-cumstances could repeat next year!

Another kind of damage occurred when underground waters, seeping through fill, washed out part of road foundation.

ABOVE: This paving damage was caused by pressure of sliding material on slope at right, forcing its way between road surface and foundation. BELOW: Man in photo has right hand at high-water mark which South Fork of Eel reached here near Phillipsville. This stretch of freeway, recently completed, was constructed five feet above high-water line of 1955 flood.

Overflow water from Sacramento River passing over weirs into Yolo Bypass during week of Christmas Flood makes Interstate 80 look like causeway to Key West. (Photo courtesy of Vernon Giles, Carmichael Times.)

CHRISTMAS FLOODS

PART 2: *Elsewhere in the State*

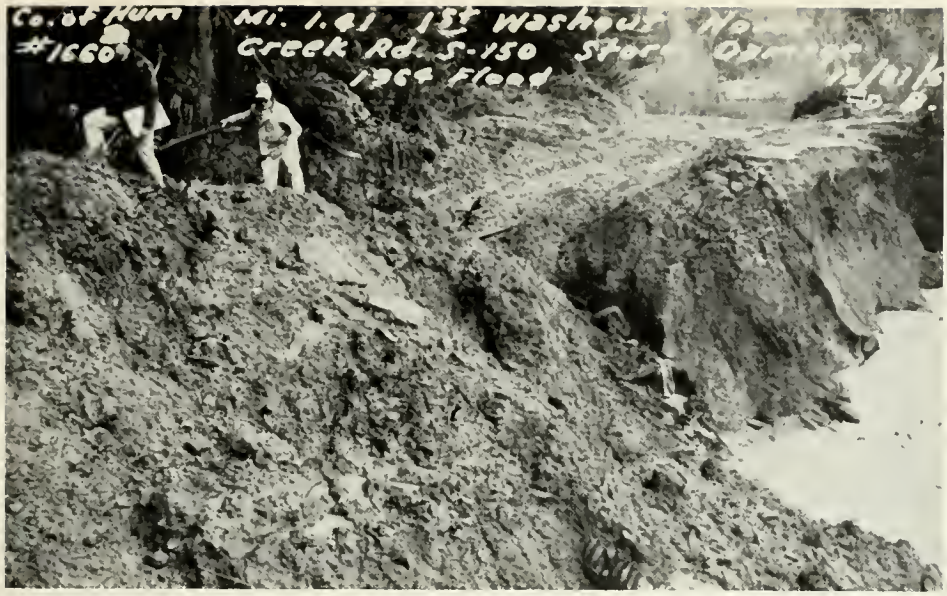
Editor's Note: Because of space and time considerations, the two flood articles in this issue of the magazine cover only the actual damage caused by the December storms. Followup articles on action taken to reopen the roads will appear in succeeding issues.

The storms which devastated the north coastal counties in December 1964 spread eastward and southward across much of northern California. Before they subsided more than a score of counties had been designated as disaster areas, with some of them suffering very heavy damage to both private and public property. Included was bridge and highway destruction running into many millions of dollars.

Damage to state routes was also heavy, particularly in the northwestern quadrant of the state. Not only was the Redwood Highway rendered completely unusable, but so were several other routes such as US 299 between Arcata and Redding, Sign Route 36 between Fortuna and Red Bluff, and Sign Route 96 up the Klamath River.

On most routes there were many temporary interruptions. At one time all trans-Sierra routes were closed by high water, snow or blizzard conditions, except a northerly route via State Sign Route 44 and Susanville.

Along the north coast the heaviest rainfall seemed to strike Mendocino County first, then gradually spread



Engineers surveying damage on county road in Humboldt County, seeking route into Rio Dell, struggle through knee-deep mud along banks of the Eel River. This route is now being used temporarily as part of the Redwood Highway.

Typical damage to county road, Humboldt County.

northward and eastward. While several stations near the headwaters of the Eel recorded more than 20 inches for a two-day period, this intensity was not equaled in other parts of the state. Probably there was somewhere around 12 to 16 inches in many parts of the Klamath and Trinity Ranges on these two worst days, which had its effect not only on westward flowing streams, but also on those streams draining eastward into the Sacramento Valley.

Farther to the east, Blue Canyon, west of Donner Pass and on the headwaters of the American River, recorded more than 23 inches of rain for the four days of the worst storm. Most places in the Sierra, however, got only about 12 inches during these four days, but it was over ground already saturated by a series of lighter storms.

The effect of these earlier storms had already been felt by the 21st, when several counties reported road closures from slides and flooding. On the state system, Highway 101 was closed by slides and flooding at Benbow, and State Route 1 was closed at the Garcia River by flooding.

On the 22nd, reports of damage over a wide area were coming in. All roads into Eureka were closed indefinitely. Interstate Highway 80 was closed at Cisco due to flooding. The Southern Pacific Railroad suspended service over the Sierra and north into Oregon where the road was closed at Crescent Lake. Humboldt, Del Norte, Shasta, and Mendocino Counties were declared disaster areas.

The washout at Bluff Creek, across State Route 96 along the Klamath River. Original streambed passes along ledge and out of left center of picture, but flow of water was so great stream broke through solid rock many feet higher than bed and cut new channel across highway. Note detritus carried down into river.

Hospital Creek on Trinity River near Hoopa brought down so much debris it filled channel, and covered highway with gravel several feet thick. This was a common type of damage in this storm, and required reestablishment of the channel in each case. Note creek "delta" in river.

By the 23rd, water had to be released from some dams. Almost every northern county was reporting closures, flooding, and bridge losses. Schools were closed. In many places in the Sacramento Valley the roads on fill were like causeways across inland seas. A contractor working on a highway job near Orland watched one of his pickups as it was swept end over end down Stony Creek. Yuba County lost its new 155-foot Oregon House Creek Bridge, which was under construction and just ready for its final pour.

All the Sacramento River bypasses had to be opened, which flooded many low-level roads. As the storm spread southward, the Tuolumne River flooded State Sign Route 120, and there were slides and flooding on Sign Route 108 in Sonora County. Sign Route 70 in the Feather River Canyon was closed, as was Sign Route 20 east of Nevada City.

All routes connecting California and Oregon were closed. Interstate 5 was closed near the Oregon line by flooding, reduced to one lane at Dunsmuir by a slide, closed on US 99W south

BELOW: Destruction of culvert and road on State Route 96. Trail across top of picture is emergency road. Washed-out culvert can be seen in circled area.

BELOW: Slides and slipouts on State Route 96 left this government equipment (seen in circle) trapped, unable to get out. (Both photos courtesy of Six Rivers National Forest, U.S. Forest Service.)

On December 27 this cable carrier was being used to carry people and small quantities of supplies across Canyon Creek at Junction City. Road in background is US 299. (Photo courtesy of United Press International.)

of Red Bluff, and US 99E between Roseville and Lincoln.

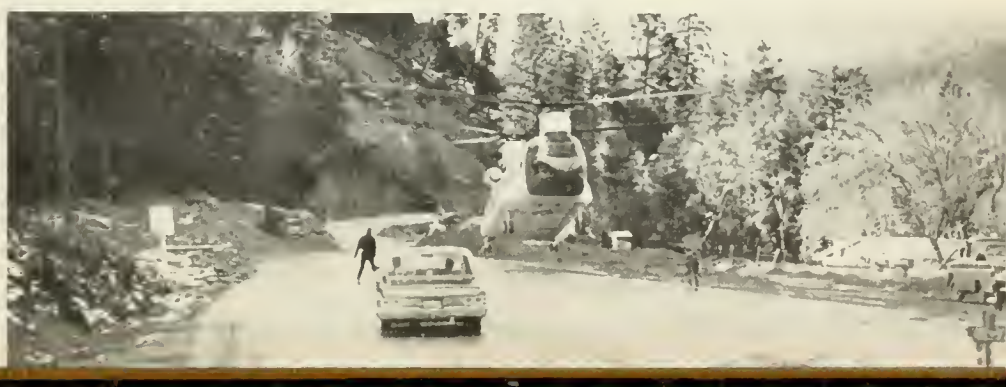
Sign Route 49, traveling through the foothills across dozens of streams, had many closures. Hell Hole Dam, under construction on the Rubicon River in the Sierra, failed and loosed a wall of water which three hours later wiped out the State Sign Route 49 bridge near Auburn. A few miles farther north the fine old covered bridge on the county road at Bridgeport barely missed destruction when the Yuba River rose to the bottom of its housing.

Siskiyou County reported 15 bridges destroyed, and 15 more with damaged approaches. This was later modified, after the water went down, and several bridges thought lost reappeared. All roads in the county were impassable, with heavy flooding on the Klamath, and along the lower Trinity.

Governor Brown telegraphed the President names of 10 more counties nominated as disaster areas. Humboldt County reported nine county bridges destroyed, and the first loss of life in the storm when a road collapsed beneath a jeep, and vehicle and driver were swept away in the Klamath River.

In many places travel by air was the only means of access. A Division of Highways photographer caught here an Army Caribou plane over a destroyed bridge on US 299.

ABOVE: Visible in this photo at the Arcata airport are Air Force, Navy, and private aircraft which provided food and other supplies for the isolated areas for weeks, and made countless rescue and reconnaissance missions. (Photo courtesy of Eureka Newspapers, Inc.) *BELOW: Big, two-rotor Marine helicopter lands on street of isolated Willow Creek. A machine like this carried fuel for equipment to many isolated emergency road contracts. Aircraft even brought in hundreds of tons of feed for Humboldt County's dairy cattle.*



This special congressional subcommittee of the U.S. House of Representotives Public Works Committee toured the flood-ravaged areas of the several stricken western stotes to get firsthond knowledge of the extent of the disaster. Here photographed at Redding Airport, January 12, 1965, they are, left to right: Congressmen Horold T. (Bizz) Johnson of California; Jim Wright, Texas; Robert E. Jones, Alabomo (chairman of subcommittee); Californio Division of Highways Senior Highway Superintendent Henry Pickrell, District 2; Congressmen Don H. Clausen, Californio; ond Williom H. Harsho, Ohio.

In Shasta County a hole 70 feet deep and 100 feet wide developed across the four lanes of Interstate 5 at Meers Creek north of Redding, when water undermined the fill. The district engineer commended temporary employees M. D. Crowe and J. C. Garrigus for noticing the pavement beginning to sag at 2 a.m. and standing by to stop traffic.

On the 24th, El Dorado County reported 12 to 20 inches of rain in the Tahoe area during the storm, which delivered 1.2 million acre-feet of water into the lake. Plumas County reported the loss at Chester of the main bridge over the North Fork of the Feather, and heavy flooding across Sign Route 70 below Pulga. Closures on Interstate 5 near the Oregon state line were repaired, and hundreds of cars, plus 14 Greyhound buses, all stalled there for hours, streamed northward.

Storm damage and flooding was widespread over the entire northwestern United States. In California many roads had to be patrolled by sheriff's deputies and California Highway Patrolmen to screen travel over dangerous sections.

Traffic on Interstate 5 north of Yreka was still one-way on the 27th, and US 50 was closed by slides between Placerville and Meyers. Sign Route 70, the Feather River route, was closed by slides 12 miles east of Jarbo Gap. Also closed were Sign Routes 1, 16, 20, 36, 41, 96, 140, 169, and US Routes 199 and 299.

By the 28th the snow level had dropped to the 2,500-foot level in the mountains, with heavy falls in the coast ranges, the Klamaths, the Siskiyous, and the Trinitys, adding to the misery of those isolated, and hampering emergency reconstruction. However, the rainfall at lower elevations slowed, and streamflows subsided, allowing many minor road closures to be repaired. In the north dozens of highway crews were still cut off by bridge and road destruction, but the radio-equipped cars kept a steady flow of information coming into headquarters at Eureka and Redding.

The damage to highways was extensive but generally speaking, the older the road the more closures there were. The narrow, winding roadways are very vulnerable to slides and washouts. Maintenance is difficult in any winter on these older sections. The cut slopes are unledged and steep, and when they become saturated with water, they slide, either covering the road or carrying the road with them.

On US 299, running from Arcata to Redding, this type of damage was common west of Weaverville. There were few bridges in this vicinity to go out, but the failure of the Canyon Creek Bridge at Junction City effectively prevented repair work west of it until a temporary crossing could be built. Between Junction City and Willow Creek there were many slides, slipouts, and washouts. Two washouts were so great they had to be bridged.

From the town of Willow Creek, the road heads west up Willow Creek. When the normally peaceful creek rose to become a roaring torrent, it closed six miles of the highway by undercutting. With the Redwood Highway hopelessly destroyed in dozens of places, repairs in this section between Berry Summit and Junction City were vital to reestablish road communications to Eureka.

Sign Route 36, west of Red Bluff suffered some damage on its eastern sections, and along about 20 miles of its western end there were bad washouts and slides. Three sizable bridges were destroyed on this route, also.

Possibly the worst slide damage in the entire state was on State Highway 96, which leaves US 299 at Willow Creek, then travels down the Trinity Canyon and up the Klamath from the junction of the rivers at Weitchpec. This is very rugged country, with the few settlements directly on the roads.

On the Siskiyou County road along the Salmon River, a slice of mountain half a mile high and three-fourths of a mile wide slid down into the stream, erasing three-fourths of a mile of road and damming the river. When the dam broke, a 90-foot-high wall of water roared downstream. On this

route, 17 miles of road was virtually wiped out.

From Weitchpec, at the confluence of the Trinity and Klamath, uncompleted Route 169 goes part way down the Klamath, to the Town of Pecwan. Over two-thirds of this road was destroyed.

Bridge damage in the Klamath-Trinity drainage area was heavy. The bridge at Willow Creek, connecting Route 96 with US 299 was completely destroyed, as were several other state bridges on this route. In the Weitchpec-Orleans-Somes Bar vicinity, every bridge was destroyed, both state and county.

Included was the state bridge at Somes Bar and the beautiful prize-winning suspension span at Orleans, the fine county bridge at Martin's Ferry which gave access to the county road to Orrick and US 101 and the jewel-like little Forest Service suspension bridge at Ishi Pishi. Upstream there was further bridge damage, and all along the canyon terrible road damage. When the flood subsided, people who lived in these communities could be provided with food and supplies only by helicopter.

Gaping washout from what is normally an insignificant trickle of a stream is typical of damage throughout the several northwestern counties in the December 1964 floods. This is State Route 208 in Mendocino County, west of Leggett.

Mendocino County suffered very heavily, both from the Russian and Eel Rivers. Damage was particularly heavy in the vicinity of Covelo and Dos Rios around the main Eel and its North Fork. Here also the railroad suffered heavily. These are examples of some of the worst hit areas. Many other counties suffered damage, some of them substantially. The photos herewith tell the story better than words.

County losses alone, ignoring state losses, on first estimates, totaled 340 miles of roadway, and 104 bridges. The table below lists these losses; and their dollar value:

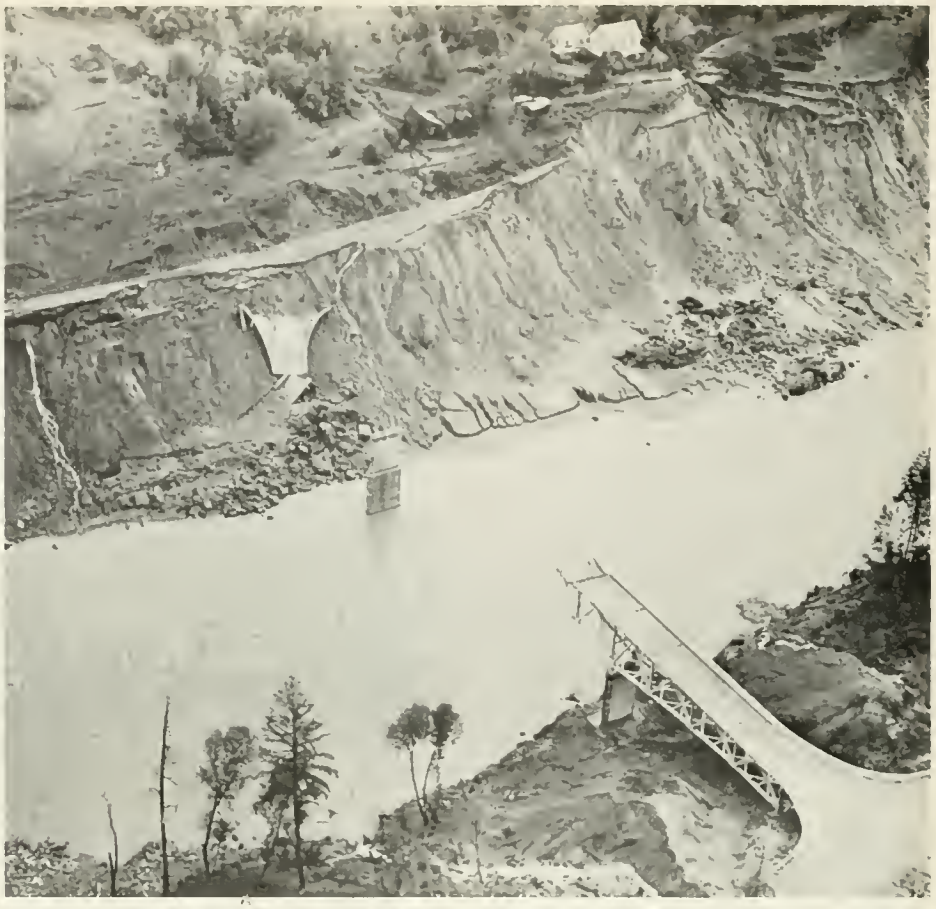
County	*Cost*	*Miles road*	*Bridges*
Butte	$112,000	2	
Colusa	166,000	10	
Del Norte	1,940,000	25	5
El Dorado	142,000	5	4
Glenn	258,000	2	1
Humboldt	6,200,000	20	21
Lake	550,000	6	9
Lassen	17,000	3	
Mendocino	6,650,000	110(?)	14
Modoc	23,000	3	1
Napa	113,000	2.8	1
Nevada	52,000	.1	1
Placer	293,000	2	1
Plumas	217,000	5	2
Shasta	327,000	7	4
Sierra	200,000	10	3
Siskiyou	2,368,000	60	20
Sonoma	566,000	6.1	2
Tehama	335,000	8	5
Trinity	2,030,000	50	10
Yuba	124,000	2.5	1
Total	$22,683,000	339.5	104

Guerneville in Sonoma County from the air on December 24, 1964, while Russian River was in flood. State Route 116 travels across photo about one-third the distance from the top. (Photo courtesy of Santa Rosa Press Democrat.)

ABOVE: One of the more than 100 county bridges damaged. This is Trinity County's Carrville Bridge over the Trinity River. BELOW: The damaged Feather River Bridge, Chester, Plumas County. (Photo courtesy of Feather River Bulletin.)

ABOVE: "Before" photo of the Forest Service Bridge across the Klamath River at Ishi Pishi, on the Humboldt-Siskiyou county line. BELOW: "After" photo of same bridge, showing only abutment remaining, indicates height and power of flood in Klamath Canyon.

ABOVE Whittemore Bridge on Federal Aid Secondary Route 977 in Humboldt County. BELOW: This Mendocino County bridge across the upper Eel River on road to Covelo withstood flood despite debris. (Photo courtesy of Santa Rosa Press Democrat.)

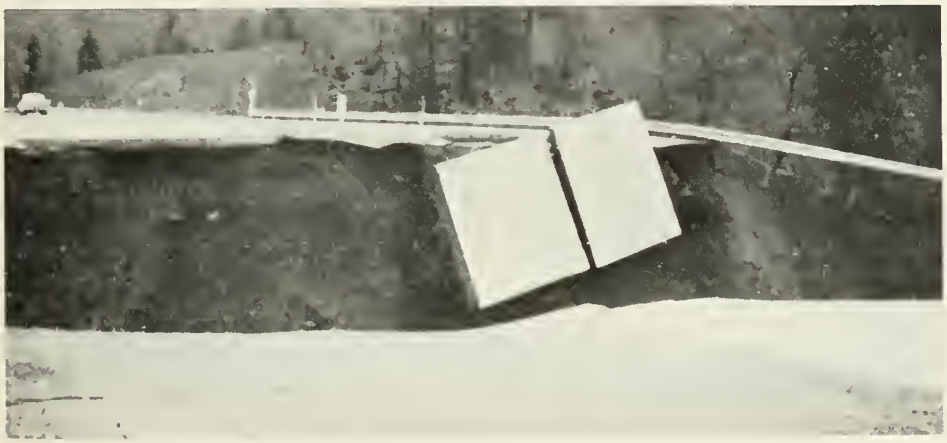


This photo of destroyed Martin's Ferry Bridge, on Humboldt County route between US 101 and Klamath River towns, clearly shows power of the Klamath in flood. Top of pier on other side of stream is 95 feet above normal river flow and subsiding waters left driftwood on it. River height here is estimated to have reached somewhere between 110 and 115 feet. Note also washouts and undercutting of cliffs in upper right which previously supported the road. (Photo courtesy of Eureka Newspapers, Inc.)

BELOW: Until December, this was the beautiful State suspension bridge at Orleans, which won an award for design in 1940. Flood topped deck before bridge gave way. (Photo courtesy Six Rivers Forest, U.S. Forest Service.)

ABOVE: Washed-out Cold Creek Bridge, State Sign Route 20, Mendocino County, east of Calpella. BELOW: Thomas Creek Bridge on county F.A.S. Route 107B near Paskenta, Tehama County.

ABOVE: Damage on Humboldt County road from flooding Sprowel Creek, December, 1964. BELOW: Mears Creek washout, Shasta County, on Interstate Route 5, December 23, 1964. Highway foreman happened to have camera focused and cocked when two-lane piece of paving broke off and fell.



ABOVE: Pier settlement, county bridge over South Fork of Cottonwood Creek, Evergreen Road, Tehama County. BELOW: Partly destroyed Oregon Creek bridge, Celestial Valley Road, five miles south of Camptonville, Yuba County.

BELOW: Collapsed bridge at Willow Creek, on State Route 96, near junction with US 299.

ABOVE: Looking across gap of fallen North Fork of Russian River Bridge at Calpella. Severance of utility lines disrupted telephone service for entire area. (Schroll Studio photo courtesy of Santa Rosa Press Democrat.) BELOW: Stephens Bridge over Coche Creek, Yolo County, 5½ miles west of Woodland.

US 99-Kingsburg

Last Unit of 21-Mile Relocation Completed

By JAMES M. McDOWELL, District Construction Engineer

A dramatic wave-through by a perspiring, red-coated flagman was the only ceremony in evidence as the third and final section of the Kings River to Fresno relocation of the Golden State Freeway was opened to traffic in early August, eliminating the last two traffic signals on US 99 in District 6.

The entire relocation lies approximately a quarter-mile west of the old route, which will continue in use as a local service road for the southern portion of Fresno and the Cities of Kingsburg, Selma, and Fowler.

The north (Fresno) end of overall project, showing the direct connection to Golden State Boulevard, the superseded highway.

Ramps with temporary connections to California Avenue indicate the diagonal alignment of future Route 41 Freeway into downtown Fresno.

Recently completed Unit Three is rom south of Kingsburg to a con- ection north of Selma with Unit One, which was described in the Sep- ember–October 1962 issue of this nagazine. Unit Two, completed in October 1963, extended the central roject to the north and made connec- ion with the Fresno Freeway at the ntersection with Highway 41.

Part of Important Route

This 21 miles of San Joaquin Val- ey highway is part of the most im- portant and heaviest traveled route in entral California, serving a large por- ion of traffic between the richest ag- icultural area in the nation and the najor metropolitan areas of the state. t also carries a considerable amount f recreational traffic between these reas and mountain or coastal resorts.

With provision for future widening o six and eight lanes, the southerly ine miles were constructed with four anes, the remainder with six. Thirty- even major structures were included n the work; 18 interchange facilities, 1 street separations, 3 railroad separa- ions, a pedestrian overcrossing, and 4 lrainage pumping plants.

Construction Casts

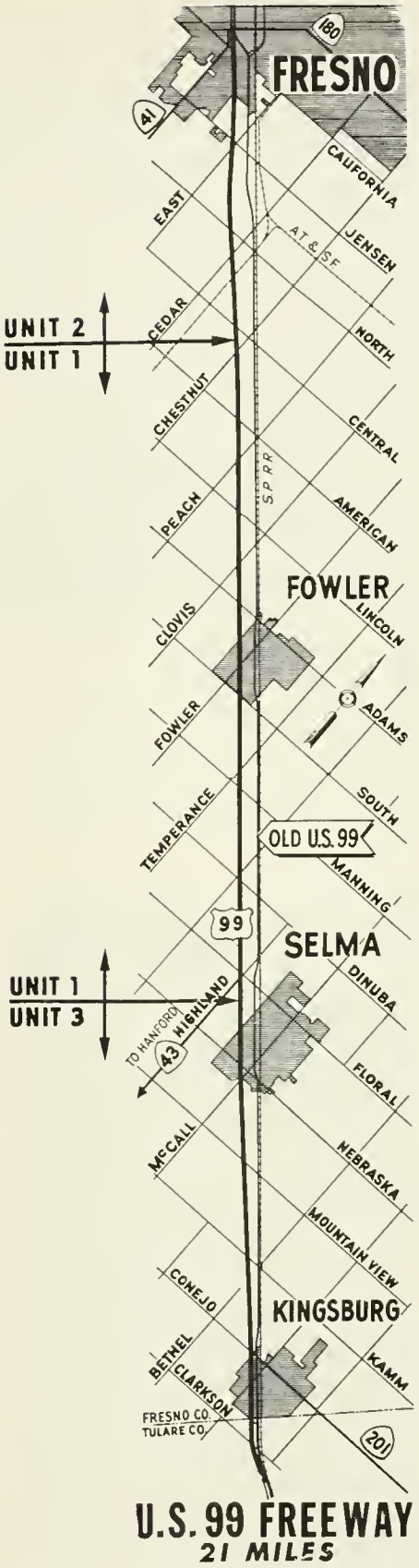
Construction costs for the three projects amounted to nearly 17 mil- ion dollars, and included:

- . . . enough concrete to build a three-foot-wide sidewalk half- way across the United States
- . . . excavation sufficient for 30,000 family-size swimming pools
- . . . asphalt surfacing adequate for a driveway 350 miles long
- . . . an amount of steel equivalent to that in 7,000 automobiles

Right-of-way requirements were lso extensive: a total of 842 parcels f land were acquired involving ex- penditure of 9½ million dollars.

Rapid Acceptance

As evidence of the rapid acceptance f slip-form paving in California since ts introduction in late 1959, all 187,000 cubic yards of concrete pave- nent were placed in this manner. Roughly three-quarters was done with he Lewis machine. The remainder was placed by the Guntert-Zimmer-



MAP ABOVE: The 21-mile freeway relocation from Kingsburg to Fresno was completed in three units. Unit 1 was opened to traffic in November 1962, Unit 2 in October 1963 and Unit 3 in August 1964.

man machine, controlled by an elec- tronic guidance system receiving in- structions for line and grade from a preset, tensioned piano wire.

Hand in hand with new placing methods were new ideas in concrete manufacture. Where mixing was for- merly accomplished by one or more movable mixers with their stretched- out supply trains of water trailers and dry-batch trucks, two of these proj- ects utilize central-mixed concrete from jobsite batch plants. Mixing was done in eight-cubic-yard batches and hauled in nonagitating dump trucks for distances of several miles to the paving spread. The concrete was merely dumped ahead of the paver which spread, consolidated, and ex- truded the slab to required dimensions while the trucks returned for another load.

Old Style Equipment Replaced

Fast being relegated to the past along with other old-fashioned prac- tices are the numerous teams of blade operators and "guinea hoppers" once relied upon to smooth the subgrade. Often being accused of "being right once every 50 feet," they are being replaced with machines capable of spreading the structural layers to tol- erances once thought impossible. Both the Lewis subgrader—a machine sim- ilar in appearance to the paver—and the Gurries roadbuilder—a wire-con- trolled spreader—gave excellent results at considerable savings in equipment costs and manpower.

An innovation in dirt moving on the Unit Three section achieved the amazing production rate of 2,500 tons of imported borrow per hour. A fleet of scrapers making high-speed shallow cuts passed over a set of specially built elevated scales, were weighed, and then dropped their loads into a large hopper. The material was then dropped through hydraulic gates into waiting double trailer rigs capable of a 100-ton fast haul to the embankment area.

Pipe Cast in Place

Long lengths of concrete irrigation pipeline were cast in place with a Fullerform machine, which does away with laborious hand placing and mortaring of section after section of

heavy pipe. In this process fresh concrete from transit-mix trucks is deposited into a hopper of the movable machine, which straddles a long, inflatable neoprene "sausage." This tube, which determines the inside diameter of the pipe, is placed in a carefully built trench, anchored, and "swallowed up" by the moving pipe maker as the concrete is packed around it. When the concrete hardens, the tube is deflated and repositioned for the next pour.

Yet another development in modern highway construction was used extensively on these projects. Bridge deck finishing has always required a keen eye for detecting, and strong back muscle for correcting, surface irregularities. The Bidwell Finisher, a combination strikeoff and longitudinal float, rides on screed rails outside the pour and produces excellent results. Even with reduced crews, finishing time was lessened by hours from old "grunt and groan" methods.

Mendocino Avenue Overcrossing and Overhead south of Kingsburg. The Tulare-Fresno county line is just beyond the structures.

Work Started in 1961

Work on Unit One was begun by R. A. Westbrook, Inc., and Morrison-Knudsen Co., Inc., in March of 1961 and completed in November of the following year. This 9.7-mile project between Highland Avenue (Route 43) in Selma and Chestnut Avenue in Malaga is of initial six-lane width and provides traffic interchange facilities at Highland-Floral Avenues, Manning Avenue, Merced Street in Fowler, Adams Avenue, Clovis Avenue, American Avenue, and Chestnut Avenue.

Mountain View Avenue, on important east-west county road.

Unit Two got underway in November 1961, with R. A. Westbrook, Inc., Morrison-Knudsen Co., Inc., and Richard N. Moseman as contractor. Of six-lane width, this 5.5-mile contract ties to the existing Fresno Freeway on the north and has connecting ramps at Central Avenue, Cedar Avenue, North Avenue, Jensen Avenue, the future Route 99/41 interchange, and at Ventura Street.

The joint venture of Fredrickson and Watson, Kenneth H. Golden Co., and Hess and Dubach commenced work on the final section in April of 1963. Interchange ramps for the four-lane freeway are provided at Mendocino Avenue in Kingsburg, Conejo Avenue (Route 201), Bethel Avenue, Mountain View Avenue, and at Second Street in Selma.

Project manager for Westbrook, Morrison-Knudsen on Units One and Two was Oliver Pope; for the Fredrickson and Watson, Golden, Hess and Dubach combine on Unit Three the superintendent was William Brewer. Resident engineer on Units One and Three was Nelson Humiston; on Unit Two, Tom Conley.

Lebec Project

Modernizing of Interstate 5 Continues Over Ridge Route

By D. L. McKENZIE, Resident Engineer

It is August 1772, and Don Pedro Fages is leading his weary band of Spanish militia on the arduous trek from San Diego to the new mission at San Luis Obispo. The troops have trudged up and over the Cajon Pass, across a portion of the Mojave Desert, through the Lake Hughes area, continued on over the Tejon Pass, and are rounding the toe of a peak which will soon reveal the beautiful sight of a lush green meadow some half-mile wide by three miles long bordering Castaic Lake. The assemblage will soon push on down Cajon de las Uvas (Grapevine Canyon), across the southwesterly corner of the San Joaquin Valley, by Buena Vista Lake, and on to San Luis Obispo. Here in this mountain meadow location only a dim trail leads ahead.

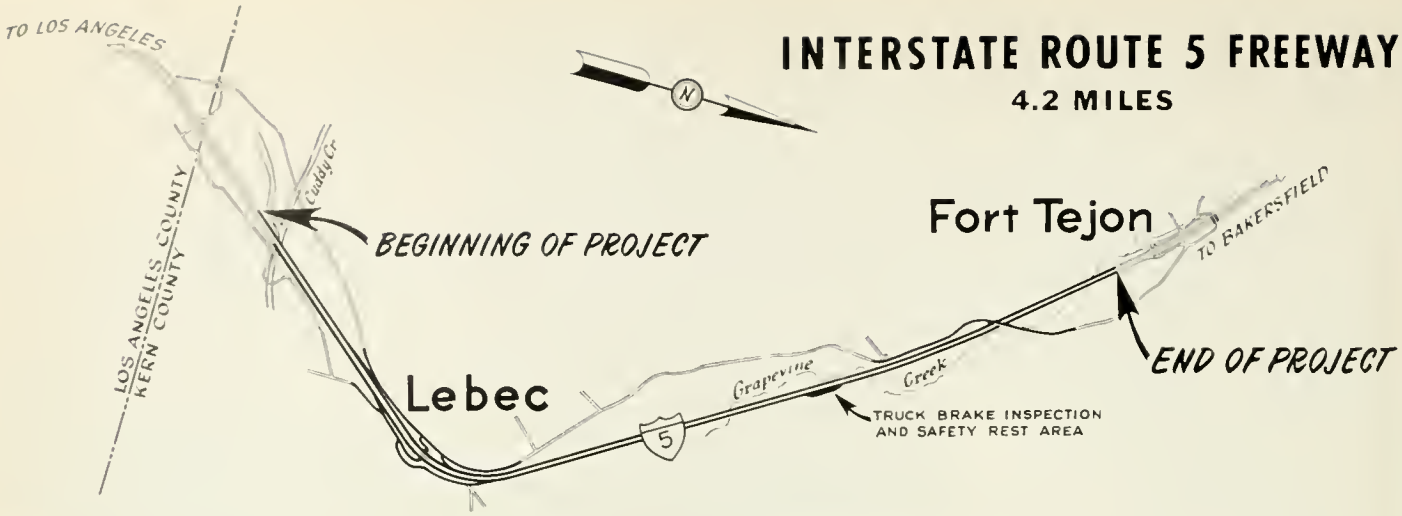
If time could be instantaneously advanced for Don Pedro and his troops, and the year were suddenly changed from 1772 to the year 1915, our group would see a 20-foot-wide pavement winding around the edge of the meadow which could, if the vehicles were available, easily be traversed at speeds of 25 to 35 mph. If the year were 1936, the group would see a 30-foot ribbon of PCC pavement that crosses the meadow, rather than skirting it, on an alignment that is nearly the same as that in use today. If the year were 1952, the road would be a four-lane expressway. If the year were 1964, an eight-lane full freeway would be seen stretching toward the top of Grapevine Canyon.

A view northward along the new eight-lane Interstate 5 Freeway between Lebec and Fort Tejon on the Ridge Route.

Northbound truckers will be able to check out their rigs at this location off the freeway before beginning an eight-mile descent to the San Joaquin Valley floor. Weary travelers will also find this a convenient rest stop.

Road Work Begins

Work began on April 29, 1963, converting a 4.7 mile length of four-lane expressway to an eight-lane full freeway from one-half mile north of the Los Angeles county line to Fort



This map shows the location of the new freeway section which extends from Fort Tejon to south of Lebec, a distance of more than four miles.

The combination truck brake inspection area and safety rest stop can be seen in the lower center of this aerial photo.

Tejon on Interstate Route 5, known to most people as the "Ridge Route". It was completed on September 18, 1964. Previously, a 6.6-mile section just north of this project was completed in July 1960 at a construction cost of $7,430,000. Work on a contract in District 7 has recently been started to continue an eight-lane freeway development another 5.4 miles to the south.

For the most part, the project completed in 1964 was a standard highway construction effort. The feature that set it apart was the attempt to salvage as much as possible of the inherent value of the existing highway pavements, and the resulting necessity for carefully staging the traffic handling in order to accomplish this salvaging without delay or danger to the traveling public.

Terrain Relatively Level

The project terrain looks relatively level, but only because of 6-percent grades near each end of the job—Grapevine grade to the north and Tejon Pass grade (over Holland Summit) to the south. Grades on the project varied from 2 percent to 4¾ percent, uphill to southbound traffic.

The existing southbound roadway consisted of two lanes of PCC pavement constructed in 1951. Approximately 20 percent of the outer lane needed replacing. To accomplish this replacement, a series of southbound traffic moves were made. First, the southbound traffic was channeled into

1 two-lane pattern using the existing outer AC shoulder. During this time the new eight-foot-wide inner shoulder of AC was constructed. Then the southbound traffic was channeled into 1 two-lane pattern near the median using the newly constructed inner shoulder as a part of the traveled way.

Outer Lanes Reconstructed

Next order of work was the reconstructing of portions of the outer lane of the existing PCC pavement. To provide room for work, traffic was merged into a single lane nearest the median, using the shoulder and a portion of the inner lane.

The Special Provisions required that only 1,000 feet of one-lane road could be in use at one time so that the slow-moving uphill trucks would not bottle up the traffic flow. A traffic flow study indicated that if 3,000 feet of two-lane roadway were available between the one-lane segments there was no noticeable traffic delay. This course was pursued to completion of the slab replacement program. Replacement was for the full lane width (12 feet) at lengths varying from 6 feet to 690 feet. As each 1,000-foot increment was completed, traffic was restored to two-lane usage by continuing to use the inner shoulder and portions of the PCC pavement.

When the slab replacement work was complete, construction of the additional two lanes of southbound pavement was begun. A six-foot "buffer" area was barricaded off along the edge of the existing lanes to keep vehicles clear of the dropoff during subgrading operations. Using a Lewis slipform paver and a fleet of 15 transit paving mixers, the southbound paving was completed.

Traffic Uses Southbound Lanes

When the outer AC shoulder was in place, all traffic was routed onto the southbound pavement. A 1-inch by 4-foot AC pad was placed along the center of the southbound four-lane pavement, and a double-double yellow stripe was placed on the pad, to serve as a divider between the two directions of traffic. This provided two lanes for each direction of traffic while the northbound roadway construction was in progress.

A down-canyon (northword) view toward the Son Jooquin Valley. Lebec is at lower left.

A southward view from approximately the some location as the above photo with Lebec visible in right foreground.

The inner two lanes of the northbound lanes were constructed as a PCC blanket overlay on the existing pavement. Some planing of high spots was necessary, and the subgrade was brought to the proper grade by placing an AC leveling course. The outer two lanes were fully subgraded. Prior to beginning the northbound paving operations, the contractor changed his transit paving mixers from the fixed drum type to the tilt-drum type. The average daily production soared because of the reduced discharge time. As is usually the case with slipform paving, a better Profilograph daily average was obtained when the higher production rate was sustained.

Inspection Area Constructed

A combination truck brake inspection area and safety rest stop was constructed along the northbound roadway near the middle of the job. Located in a picturesque setting alongside the green meadow under some stately old oak trees, the rest stop is being used by a large number of travelers. A future project, now in the planning stage, will add restrooms and picnicking facilities.

Prime contractor for the work was Matich Constructors of Colton. Resident engineer for the state was D. L. McKenzie. Subcontractor for bridge construction was W. F. Maxwell Company of Fontana. The state's bridge engineer was C. W. Purkiss.

Woolley Is Elected CHC Vice Chairman

The California Highway Commission has elected Roger S. Woolley of Rancho Santa Fe as its vice chairman. He succeeds Abraham Kofman of Alameda.

Woolley, a San Diego attorney, was appointed a member of the commission by Governor Edmund G. Brown in March 1959 and reappointed in 1963.

The commission elects a new vice chairman from among its members each year.

Womack Appointed to Research Committee

State Highway Engineer J. C. Womack has been appointed to membership on the executive committee of the Highway Research Board, National Academy of Sciences, for a three-year term beginning in January 1965.

Womack was notified in December 1964 by Chairman Richard C. Jordan of the academy's Division of Engineering and Industrial Research that the appointment was made upon nomination of the Highway Research Board and with the approval of the president of the National Academy of Sciences.

The academy is a private, nonprofit organization of scientists, dedicated to the furtherance of science and to its use for the general welfare. It was established in 1863 under a congressional charter, signed by President Lincoln, which required it to act as an adviser to the federal government in scientific matters.

In 1916 the academy established the National Research Council, at the request of President Wilson, to broaden its base of scientist participation. And in 1920 the Highway Research Board was organized as an agency of the Division of Engineering and Industrial Research, one of the NRC's eight functional divisions.

The Highway Research Board is a cooperative organization of the highway technologists of America operating under the support of the Academy-Research Council and with support of the various state highway departments, the U.S. Bureau of Public Roads, and other interested organizations.

Its purposes are to encourage research and provide a national clearing house and correlation service for research activities and information on highway administration, transportation and technology. It conducts an annual meeting at which many research papers are presented; disseminates and correlates research information; and works extensively through specialized committees.

Houghteling Named to Highway Commission

Governor Edmund G. Brown has announced the appointment of Joseph C. Houghteling, 39, of Sunnyvale, to the California Highway Commission. He will fill the vacancy created by the resignation of Alfred Heller.

JOSEPH C. HOUGHTELING

Houghteling publishes the *Daily Standard-Register Leader* of Sunnyvale; he is president of the Los Gatos *Times*-Saratoga *Observer* and Gilroy *Evening Dispatch* publishing companies, and vice president of the Pleasanton *Times* firm.

"By the inherent nature of his profession, Joseph Houghteling has always had a real and vital interest in the matters of state, and has served it well in various capacities," the Governor said in making the appointment. "I know he will bring this same imagination and energetic interest to the Highway Commission."

A native of San Francisco, Houghteling is a graduate of Yale University. He is vice chairman of the San Francisco Bay Study Commission, is on the advisory board of California Tomorrow, and is trustee of the World Affairs Council of Northern California. He serves as director of the Western Newspapers Industrial Relations Bureau. From 1959 to 1963 Houghteling served on the State Park Commission, the last 1½ years as chairman.

US 99–San Joaquin Co.

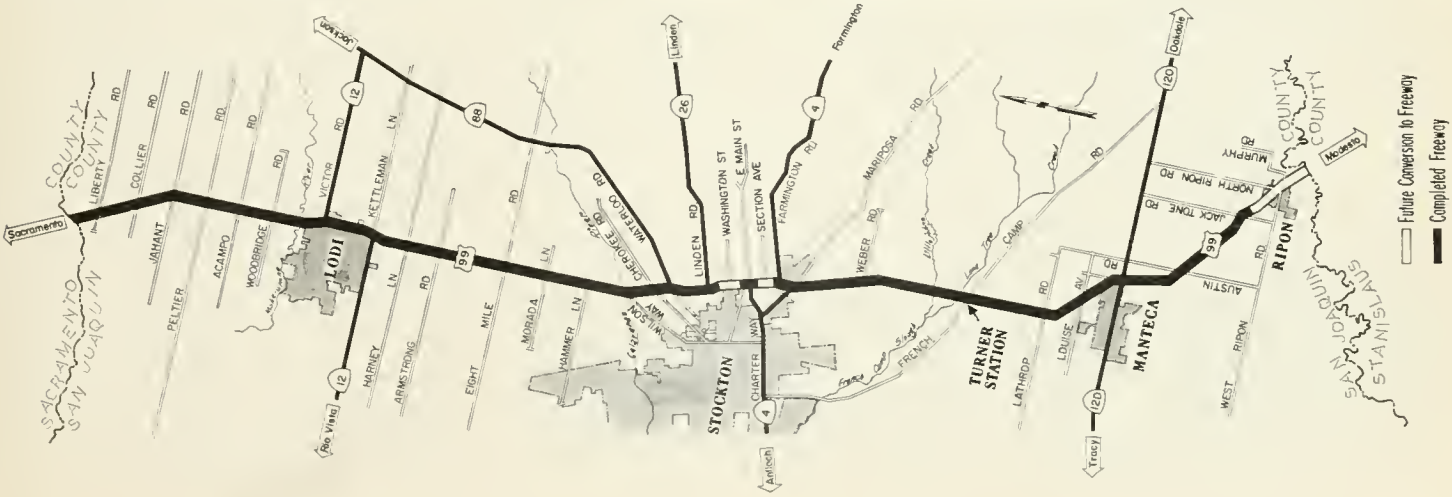
By GEORGE AVERY, Assistant Design Engineer

Throughout the length of California, motorists on US 99 have long dreamed of the time when they would travel this highway with the safety and comfort we now associate with our modern freeway system. After many years of concentrated effort, these hopes have become a near reality in San Joaquin County. The recent conversion of an eight-mile expressway between Stockton and Lodi completed nearly 37 miles of full freeway in the county. The two remaining miles of expressway are scheduled for conversion to a freeway in the near future and will end a long range reconstruction program which began many years ago.

US 99 is a part of the California freeway and expressway system. Its central location has throughout the years been very important to the economy of the flat, fertile San Joaquin County—ranked fifth in the agriculture producing counties of the nation. Convenient access to and from this highway contributes to the efficient and orderly movement of the agriculture and manufactured prod-

BEFORE: The intersection of Linden Road (Highway 26) and US 99 east of Stockton before conversion from expressway to full freeway.

AFTER: The Linden Road Overcrossing after reconstruction of this section of US 90 to full freeway.



A frontage road bordering the new freeway in the vicinity of Morodo Lane on US 99.

ucts, which include livestock, a variety of fruits, vegetables, and nuts as well as durable and nondurable manufactured goods. All are moved quickly and safely to the nearby canneries, the Port of Stockton, and the numerous local and distant markets.

Two-lane Roadways

Prior to 1930, US 99 was, in most areas, a narrow, two-lane roadway of poor alignment, but the traveling lanes were generally paved or treated with some type of oiled surface. Flooding often occurred in the vicinity of the larger waterways.

One of the earlier reconstruction projects was started in 1931. The existing roadway was completely rebuilt from Turner Station south of Stockton to the intersection of Charter Way in the City of Stockton, a total distance of slightly over seven miles. The work consisted primarily of replacing the narrow, rough riding surface with two lanes of concrete pavement and oiled shoulders. The total cost was about $250,000. Incidentally, a large portion of this concrete pavement between Lone Tree Creek and Mariposa Road near Stockton was resurfaced with one inch of asphaltic concrete in 1956 and is still in use today carrying traffic as part of the existing divided highway.

Construction Completed

In 1938, construction work was completed on a $230,000 five-mile project from Jahant Road north of Lodi to about two miles north of the San Joaquin-Sacramento county line. At that time, two lanes of concrete pavement and paved shoulders were built, with provisions for expansion to a future divided highway. This later conversion was made in 1955. Here, again, the old pavement has been resurfaced and is now being used as the southbound lanes for the freeway in that area.

With the exception of necessary maintenance work to keep the existing pavements in good condition, very little work was done on US 99 between 1938 and the end of World War II. In 1945 and 1946, the great surge in automobile and truck traffic started. The two-lane pavements became inadequate to handle the in-

creased traffic volumes, and traffic analysts were predicting even greater volumes in the future. Efforts were soon started to rebuild this major highway to at least a four-lane expressway.

Four-lane Expressways

Construction projects for the next several years were directed toward converting the existing two-lane pavements to four-lane expressways. This would provide four lanes of divided highway for through traffic with partial control of access. Grade crossings were permitted only where considered necessary.

The first expressway on US 99 was started in 1945. Eight miles of two-lane pavement north of Stockton between the Calaveras River and Lodi were rebuilt at a cost of $600,000. Shortly thereafter, the first stage of a two-stage project on the easterly fringe of Stockton was started. This work consisted of grading and structures for a six-mile expressway on a new alignment. Bids for the second stage were received in 1949, and the work consisted of paving the previously constructed roadbed. At a combined cost of $2,500,000, these two projects provided a new expressway from Mariposa Road, south of Stockton, to the Calaveras River where it joined the previously completed expressway to Lodi. A continuous 14-mile stretch of divided highway was now open to motorists, and a major delay for through traffic was eliminated since the highway was no longer routed through one of Stockton's major business districts.

Freeways

As funds became available, some of the older two-lane pavements were reconstructed to full freeways in the early 1950's. These were also divided highways but differed from expressways since full access control was acquired and crossings at grade were eliminated. The first project of this type on US 99 was completed in 1954 between the north city limit of Ripon and just north of Austin Road at a cost of $1,300,000. Four lanes of concrete pavement were built, as well as overcrossing structures at Jack Tone and Austin Roads.

This photo taken in the early 1930's shows US 99 flooded south of the Mokelumne River bridge.

One of the biggest delays to the motorist was the intersection of US 99 and State Highway 120 in the center of Manteca. The conflict of highway traffic and city traffic was nearly intolerable and construction of a freeway around Manteca was started in 1954. This freeway was completed in 1956 at a cost of $1,800,000 and was located easterly of Manteca between Austin and Lathrop Roads. Several miles of two-lane highway passing through the Manteca residential and business areas were superseded for US 99 traffic as well as three railroad grade crossings and a four-way-stop intersection.

Shortly thereafter, three miles of two-lane pavement south of Stockton between Turner Station and Weber Road were converted to a freeway. Frontage roads were constructed on both sides of the highway on the northerly half of the project. The mainline was constructed with concrete pavements, and the cost of the completed work was nearly $800,000.

Projects Started Simultaneously

In the latter part of 1955, several projects were started almost simultaneously. A troublesome grade crossing of the Tidewater Railroad Company tracks at Turner Station was eliminated by construction of the freeway between the north end of the Manteca Freeway and Turner Station. Four lanes of concrete pave-

The US 99 crossing of the Tidewater Southern Railroad tracks near Turner Station in 1929, looking north.

The intersection of US 99 and Highway 120 (Yosemite Avenue) east of Manteca as it looks now (see two photos at bottom of page). Note how the functional planting complements the structure.

ment and frontage roads were built for about $1,000,000. At the same time, two projects from the northerly city limits of Lodi to north of the San Joaquin–Sacramento county line near Galt were underway to convert the existing pavement to a freeway with frontage roads. These latter projects totalled almost 10 miles in length and cost more than $3,000,000. Interchanges were built at Woodbridge, Acampo, Peltier, Jahant, Collier, and Liberty Roads. An 800-foot concrete slab-type bridge was constructed over the Mokelumne River for southbound traffic. The existing bridge was widened to accommodate northbound traffic.

This completed the conversion of the old two-lane roadways on US 99 in San Joaquin County to either full freeway or four-lane expressway standards except for a portion of the highway in the City of Lodi. There also remained, however, several at-grade intersections and railroad crossings along isolated sections of the highway, and studies were continued toward their elimination.

The photo below shows traffic congestion in Manteca at the Highway 120 (Yosemite Avenue)-US 99 intersection prior to construction of the freeway. (See photo at top of page.)

Conversion of Expressways

In 1958, bids were opened on an $800,000 project to construct ramps, frontage roads, and structures at Mariposa and Farmington Roads east of Stockton. The heavy farm-to-market cross traffic was separated from the through traffic on US 99, thus eliminating the hazardous intersections. A 60 percent reduction in the number of accidents within the immediate vicinity of these crossings was recorded during the two-year period following their reconstruction.

Two additional projects, totaling a length of almost five miles, were started in 1961. These converted the expressway easterly of Stockton to freeway standards at a combined cost of $2,000,000. Interchanges were built at Linden (State Highway 26), Waterloo (State Highway 88), and Cherokee Roads. In addition, an underpass at the Stockton Terminal and Eastern Railroad crossing north of Linden Road was constructed to eliminate the railroad grade crossing.

The remaining expressway sections on US 99 are located east of Stockton and consist of a Southern Pacific Railroad crossing and the Washington Street connection south of Linden Road. Future construction will eliminate these expressway sections.

In February 1964, a five-mile proj-
t was completed through Lodi, the
cond largest city in San Joaquin
unty. This work extended from
rmstrong Road south of Lodi to the
okelumne River. Four complete in-
rchanges, frontage roads, crossings
r several city streets, and four lanes
concrete pavement were built for
arly $3,000,000. An interesting fea-
re was the construction of almost
e mile of a depressed freeway sec-
n in relatively flat terrain. Engi-
ering studies during the design stage
termined that the depressed section
is superior to and more economical
an an embankment section in that
ea.

Next, the four-lane expressway be-
een Stockton and Lodi was con-
rted to a six-lane freeway with
ntage roads at a cost in excess of
,500,000. Interchanges were con-
ucted at the Calaveras River, Ham-
er and Morada Lanes, Eight Mile
d Armstrong Roads, and Harney
ne. This project, which was com-
eted in December 1964, has elim-
ated the conflicts with the heavy
oss-traffic going into and out of the

BEFORE: The Cherokee Road intersection looking northward prior to reconstruction of US 99 to full freeway east of Stockton.

AFTER: Looking south towards the Cherokee Road Overcrossing following the freeway construction.

Morada district east of the freeway. In the past few years, this cross traffic had been steadily increasing due to new developments and subdivisions in the area.

aerial of the Mariposa Road (foreground) and Farmington Road Interchanges during conversion of this section of US 99 to full freeway in 1958.

Current Projects

Several projects are now being scheduled for the completion of US 99 to full freeway standards in the county. Currently included in the 1965–66 fiscal year construction program is a $200,000 project for an overcrossing structure which will permit closing the Section Avenue access opening north of Farmington Road in Stockton. The same program also includes over $2,000,000 to reconstruct US 99 from a four-lane expressway to a six-lane freeway from the San Joaquin-Stanislaus county line to just north of Ripon. An additional $300,000 is allocated to widen the existing freeway and reconstruct portions of the shoulders between Turner Station and Mariposa Road.

Beautification Is Aim

Continuous efforts have been made in recent years to beautify and improve the aesthetics of the highway by means of landscape projects wherever feasible. The 1965–66 program includes $200,000 for a planting project between Armstrong Road south of Lodi and the Mokelumne River. Additional landscaping projects of this type will be undertaken from time to time as funds become available.

Excluding minor signalization, lighting, and landscaping projects, more than $20,000,000 has been invested in the long-range program to reconstruct US 99 to freeway standards within San Joaquin County. It has been a long, hard effort to rebuild the old narrow, two-lane roads to four-lane expressways and again convert these to the modern four- and six-lane freeways as we know them today. But it is considered money and effort well spent, because the accident rate on a typical section of highway south of Stockton has decreased from 2.80 accidents per million vehicle miles in 1946 to 0.50 in 1964. As a result, the traveling public, as well as the commercial truck carrier, can now drive the entire length of the county with increased safety and convenience on one of the best highways in the nation.

Bids Called for Big Interstate 5 Project

The State Division of Highways has called for bids on a multimillion-dollar project in Merced and Stanislaus Counties.

The project consists of grading and paving to extend the four-lane Interstate 5 (Westside) Freeway construction now in progress (between Route 152, west of Los Banos, and 2.8 miles north of Route 33 in Merced County) another 13.8 miles north to four-tenths mile north of Stuhr Road in Stanislaus County.

The project includes interchanges at Sullivan Road in Merced County and at Stuhr Road in Stanislaus. Undercrossings will be constructed at West Bank and Allen Roads in Merced County, and at Poverty Flat, Shiells and Orestimba Roads in Stanislaus.

A vista point will be constructed for southbound traffic approximately a mile and a half south of Orestimba Creek.

Bids will be opened April 28 in Sacramento. A total of $7,290,000 is available for the project.

San Mateo-Hayward Spans Are for Sale

Want to buy a bridge?

The State Division of Bay Toll Crossings will stage its version of the "You wanna buy the Brooklyn Bridge?" game—only this time it will be for real.

In a month or two, the division will advertise for bids to buy the five central spans of the San Mateo-Hayward Bridge, which is being replaced by a new high-level $70 million span.

E. R. Foley, chief engineer of the division, said it may well be feasible to transport the bridge to almost any point in the world.

And it could be far less expensive, he said, to transplant the San Mateo-Hayward Bridge in this fashion over, say, the Mekong River, than to build a new bridge from scratch.

Foley announced plans to reach an international audience of potential bridge buyers by advertising in engineering journals and foreign publications.

The bridge can be transported either of two ways. It can be dismantled and reconstructed. Or entire trusses can be placed on seagoing barges and transported whole to their destination.

The five 300-foot-long bridge spans can be used as one 1,500-foot bridge or as five smaller bridges, Foley said. In fact, any combination of the sections can be used—such as combining two sections to make a 600-foot bridge and the remaining three sections as a 900-foot bridge at another location.

One restriction, however, is that one buyer must buy all five sections, Foley said.

The buyer must agree to remove the bridge soon after the new span is completed in 1967.

The new bridge will have a unique, orthotropic design, with no overhead steel supports and cables which are common on most long span steel bridges. It will be supported between the concrete piers by box girders below the roadway, which will itself be fashioned of steel and will be part of the support structure.

The result will be a modern, streamlined and uncluttered silhouette.

Jethro J. Cravens

Jethro J. Cravens, highway maintenance man II in District 10, was struck by a car and killed instantly on December 15 as he and a coworker were spreading tar on cracked portions of US 99 near Modesto.

Cravens, 44, and Harvey Eugene Smith, 35, were both struck when an automobile driver failed to heed flag warning signals, veered into the two men, and went on to hit a trailer-heater filled with boiling road tar.

A native of Arkansas, Cravens had been employed by the Division of Highways since 1953. He is survived by his wife, two daughters, and one son, all of Modesto.

Smith, who was hospitalized with extensive burns, is expected to return to work soon. The two occupants of the automobile were also injured.

District 4 Cafeteria Has 'Sinclair Room'

A small dining room included in the remodeled basement cafeteria in the District 4 office building in San Francisco has been named the "Sinclair Room" in memory of Joseph P. Sinclair, former district engineer, who died in May 1964.

The dining room, finished in somewhat more formal style than the main dining area of the cafeteria, is used for special group events organized by district employees.

The "Sinclair Room" is identified by a bronze name plaque above the entrance door, a larger commemorative bronze plaque on one of the inner walls, and a framed photograph of Mr. Sinclair on another wall. These items were financed from a fund contributed by district employees; a balance of $40.96 remaining after the purchase of the plaques and frame was sent to the Heart Fund in memory of Mr. Sinclair.

A $27,146,000 contract—a record for the State Department of Public Works—has been awarded to Murphy Pacific Bridge Builders of Oakland to erect the steel superstructure.

McKinleyville Freeway

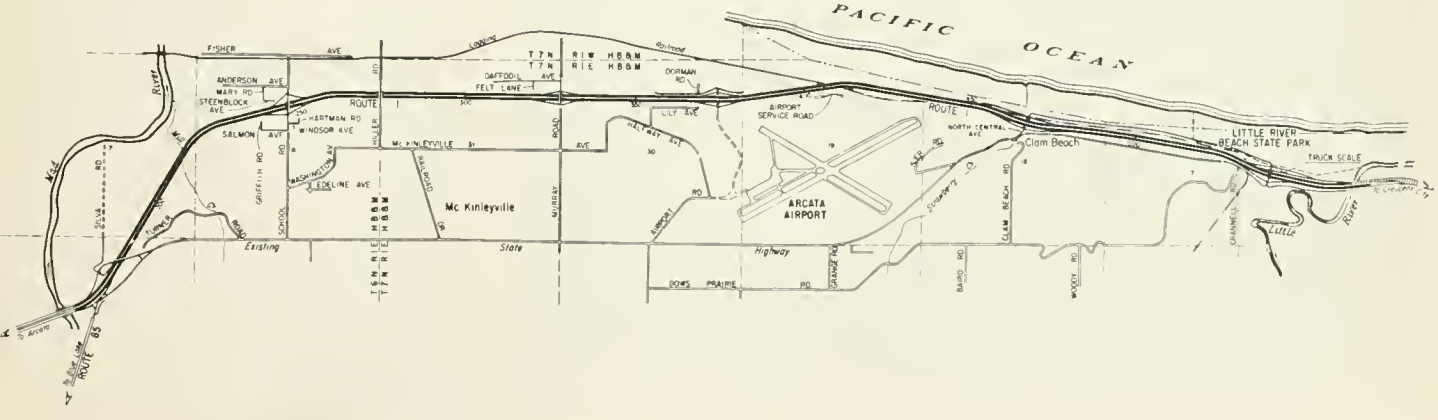
By KARL W. KAMPE, Resident Engineer

On October 3, 1964, dedication ceremonies sponsored by the local chamber of commerce were held at a scenic vista site overlooking the Pacific Ocean to commemorate completion of the McKinleyville freeway project. This latest improvement on U.S. 101 Redwood Highway was opened to public traffic on October 8, culminating almost two years of construction activity.

By action of a supervisor of former Klamath County,* "any trail wide enough for a bear to travel over is declared to be an open highway." This was historically the first apparent official effort to improve the present Redwood Highway from Mad River to Little River. The declaration did not produce much improvement, since the only resources for road building in 1855 was a levy of three days' labor per year against the able-bodied men in the county. Nevertheless, by 1876

* Klamath County, formed in 1851 and dissolved in 1874, included the general area now in Del Norte, Trinity and Siskiyou Counties.

Looking north along the new McKinleyville Freeway section of US 101 in Humboldt County.



Map of the recently completed freeway project which extends from the Mad to Little River on the Humboldt Coast.

An aerial of the McKinleyville Freeway looking south. Clam Beach Interchange is in the foreground. The old highway through McKinleyville is to the left and Arcata Airport center. Frontage road right of freeway in foreground provides parking for 350 cars and unrestricted access to the beach for 1½ miles. Photo by David Swanlund.

the trail, or road, was fit for pleasure travel since the early settlers used it to go on camping expeditions to a spot now called Little River Beach State Park.

First Improvements in 1921

The first in a series of improvements by the state in this area began in 1921 with the grading and graveling of a road 18 feet wide. This project on new alignment now provides eight miles of full freeway consisting of four lanes on divided roadways with six full interchanges and one overcrossing facility to serve the area.

The freeway bypasses the community of McKinleyville, an unincorporated area with a population of approximately 10,000. The community is largely residential with some farmland. In the normal course of development, businesses started along the main traffic artery of the community, which was the existing highway. As the community grew, traffic volume increased and accident frequencies increased proportionately along the old highway due to the large number of left-turn movements entering and leaving developments along the highway. With the opening of the freeway the community is now free to develop with greater safety to the residents.

Offers Contrasting Scenery

The new alignment offers the traveler contrasting scenery. The southerly half of the project consists of gently rolling terrain. At the midpoint of the project the road leaves an elevated plateau, dropping approximately 100 feet in elevation to a sandy beach. The motorist is suddenly afforded a spectacular view of the ocean, beach and Trinidad Head. At this point the northbound motorist on Highway 101 is able to see the ocean for the first time since leaving the Golden Gate, approximately 300 miles to the south. Appropriately, the scenic value of this panorama was recognized and a roadside vista point was constructed under the contract to permit the traveler to park, rest and enjoy the view.

The local chamber of commerce, impressed by the vista site, erected a large plaque commemorating the opening of the freeway which is the lifeline of the north coastal area. The plaque itself is a segment of a redwood log, six feet in diameter, on which is carved "Where the Majesty of the Redwoods Meets the Beauty of the Sea."

In the central portion of the project, the freeway is bounded on the east by the Arcata Airport. An interchange permits direct access to the airport, and during the time the freeway was under construction the County of Humboldt was engaged in constructing a new four-lane road from the freeway to the airport.

Parallels Public Beach

From the vista site northerly for four miles the freeway parallels a beautiful public beach that is owned by the County of Humboldt and the California Division of Beaches and Parks (Little River Beach State Park). Unrestricted access to this beach is provided for 1½ miles by a frontage road which parallels the freeway. The frontage road includes a paved shoulder for parking throughout its entire length, capable of handling 350 cars. This phase of the project has been of interest to sportsmen since this beach

yields an abundant supply of razor clams. During favorable clam tides the beach is used by hundreds of clam diggers.

Liberal use has been made of native plants to insure revegetation throughout the project. Extensive plantings of beach grass, native lupine and willows have been made to date in addition to normal seeding with rye grass and barley.

Freeway Blends With Terrain

Contour grading was performed in interchange areas and variable flattened slopes were used throughout the project where possible to insure that the freeway would blend in with the surrounding terrain.

The project officially started on April 11, 1963, and was completed on October 29, 1964, at a construction cost of $4,700,000. Although situated in an area of the state where construction seasons are short due to extensive winter rains, the project was completed and opened to traffic within two construction seasons because of the short time limit of 190 working days specified in the contract and because of the efficient use by the contractor of materials and manpower resources.

Some Construction Problems

The project was not without its share of construction problems. Extensive stripping and stabilization work was required at the southern end of the project where the new facility tied into the old highway on Bella Vista Hill. The old highway at this location had a notorious history of slipouts and accidents. The work in this area was complicated in that it was necessary to excavate and backfill the active slipout area directly below the existing highway without disrupting the normal flow of traffic.

The new roadbed also crossed Mill Creek Swamp, which preliminary borings penetrated over 60 feet in depth without encountering firm material. The swamp consisted of organic material and mud that was interlaced with ancient logs. The fill across this swamp was approximately 15 feet in height with 40-foot strut fills on each side. No stripping or stabilization

The Vista Point parking area on the McKinleyville Freeway, looking north. The log-framed dedication plaque erected by the chamber of commerce is in the center foreground.

A view of the Vista Point area (photo above) looking to the southwest.

The Crannell Interchange, looking north, showing typical lumber industry truck traffic. Planting of beach grass in foreground prevents drifting sand in the dune areas.

work was involved in this crossing; however, it was required that the fill be allowed to settle for one year before base and surfacing could be placed.

Granite Construction Company of Watsonville was the prime contractor with Richard A. Lewis as project superintendent. C. K. Moseman Company was the structures subcontractor with Bill Milot as superintendent.

James W. Beck was Bridge Department representative and Karl W. Kampe was resident engineer for District 1.

UNIQUE LIGHTING PLAN FOR NEW SAN MATEO BRIDGE

A continuous white ribbon of light extending almost 7½ miles across San Francisco Bay—that is the unique plan for illuminating the $70 million San Mateo-Hayward Bridge, which will be completed in 1967.

Plans for lighting the span—one of the longest in the United States—with twin fluorescent lights mounted atop a center concrete road divider have been announced by E. R. Foley, Chief Engineer for the State Division of Bay Toll Crossings.

It will be the first time in northern California that such lighting will have been used on a major bridge, Foley said.

The concrete divider on which the continuous fluorescent lights will rest will be about 2½ feet high. From a distance, the lighting will have the appearance of a solid white ribbon across the bay.

Red Bluff-Cottonwood

By B. L. MELTON and R. W. WENHAM, Resident Engineers

Ribbon - cutting ceremonies on July 8, 1964, officially opened a 15.2-mile section of Interstate Route 5, extending from Red Bluff to north of Cottonwood. There were two separate contracts involved in the construction, at a combined cost of approximately $7.2 million. The two contracts were programmed to permit a simultaneous completion date. A detailed description of each project follows:

United No. 1—Red Bluff to Cottonwood

The first contract, awarded in September 1961, covered the section from 0.2 mile north of Red Bluff city limits, in Tehama County, to the Shasta county line, just south of Cottonwood. Frederickson & Watson Construction Company, Lew Jones Construction Company, and Ransome Company were the successful bidders, with a joint venture bid of $3,950,236. Basically, the project involved a typical rural freeway development. The

A section of the new Interstate 5 freeway near Cottonwood in Shasta County. Note the wide, contoured grading of side slopes and median with split-level roadways and trees preserved and made part of the highway picture in the wide median separator.

Looking south along Interstate 5 toward the 4th Street Interchange, First Street Overcrossing, Cottonwood Creek Bridge and Overhead. Beyond the bridge is Bowman Road Interchange. The old highway and the town of Cottonwood are to the left.

old highway was incorporated into the new routing wherever feasible. In these locations the new lanes were generally constructed on independent grades and alignment.

Except for a short section of totally new construction near the center of the project, existing US 99 was reconstructed to function as the northbound lanes up to Nine Mile Hill, and as the southbound lanes from there northward. The reconstruction principally amounted to placing a varying thickness of asphalt concrete cover and shaping shoulders.

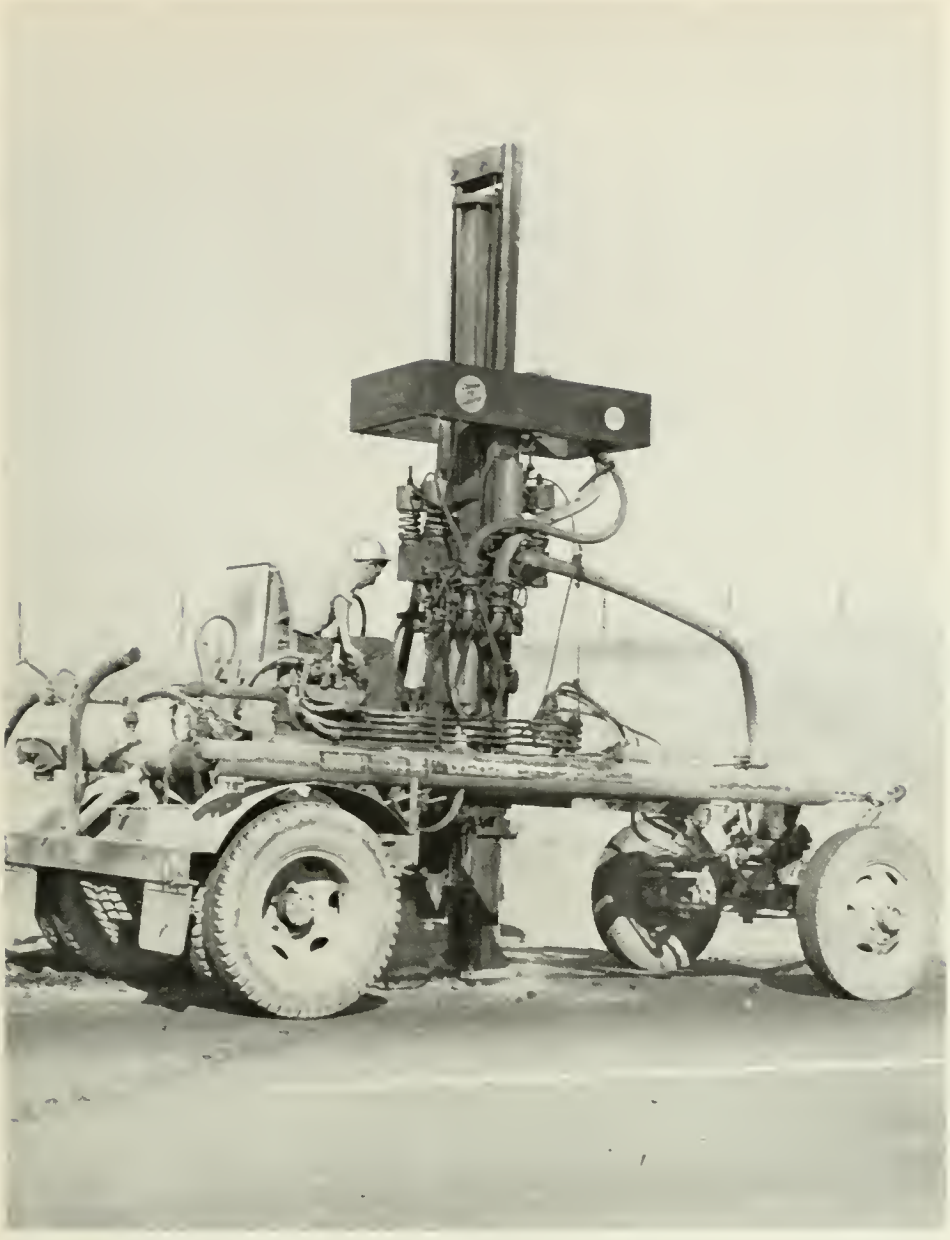
Included in the contract was the construction of a new truck-weighing station near the north end of the project. Two safety rest areas and erosion control treatment were added during the project.

A drainage feature, unusual for District 2, was the construction of a series of spillway checks near the southerly project limit. These were utilized as energy dissipators in a 12-foot bottom channel to minimize the tendency of channel material to erode.

Prestressed Bridge Girders

Because this project incorporated existing US 99 into the interstate freeway, it was necessary to provide for traffic at each of the six overcrossing structures. Special efforts were made to hold traffic delay to an absolute minimum. To comply with these conditions, bridge designers were faced with the alternative of using either steel girders or precast and prestressed concrete girders for the overhead structures. On this job economy dictated use of the concrete girders.

Each overhead structure consisted of two center spans, varying in length from 80 to 97 feet, with shorter approach spans. Only the girders in center spans were prestressed; the remaining girders were precast with conventional reinforcement. The girders were manufactured and trans-



A heavy-duty pavement breaker pulverizes a section of existing highway to eliminate slobbing action.

ported to the job site by truck. The advantage of these construction methods became apparent when traffic delays were held to less than 20 minutes for each installation.

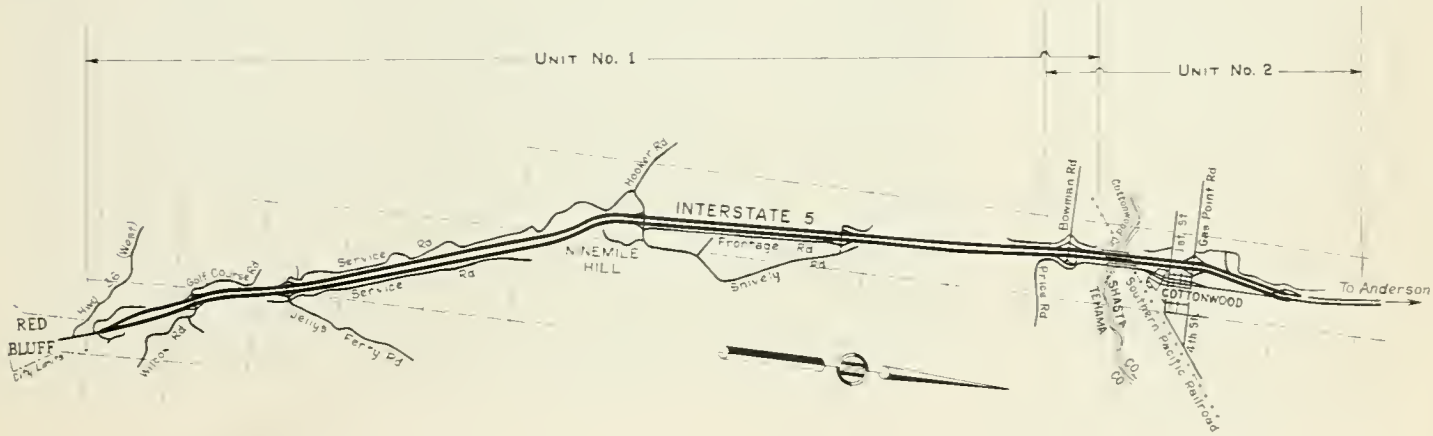
Special Equipment and Techniques

One piece of equipment that was used, which generated interest on both a district and statewide basis, was a cement-treated base spreader. Affectionately dubbed "The Monster," this machine spread the mix in lifts 26 feet in width, while operating at a rate of 400 tons per hour. When operated with care, it was capable of turning out good results. Of 32 Headquarters' audit samples taken, only one was outside the allowable tolerances, which gives favorable indication of the machine's performance capabilities.

Safety Rest Areas

As a result of a statewide program initiated for the purpose of providing pleasant travel conditions and greater highway safety, two roadside rest areas were constructed on this project. These were placed at staggered locations on both the north and southbound lanes. Each rest area can accommodate in excess of 20 vehicles and was located so as to take full advantage of the plant life indigenous to this area. A contract is currently underway which will provide sanitary facilities, picnic tables and other miscellaneous facilities at each location.

The contract was completed on May 1, 1964. R. P. Brodie of Fredrickson & Watson Construction Company was project superintendent; Mark E. Cessna, Jr., and Bill L. Melton were resident engineers; and N. E. Spickle-



Location of the new 15-mile freeway section on Interstate 5 between Red Bluff and Cottonwood is shown in the above map.

A 30-ton precast prestressed concrete girder is installed at Bowman Road Interchange, south of Cottonwood.

mire was the Bridge Department representative.

Unit No. 2—Cottonwood Freeway

On July 8, 1964, 3 miles of modern freeway were opened to traffic. This project extends from 0.5 mile south to 2.5 miles north of the Tehama-Shasta county line, skirting the westerly edge of the Town of Cottonwood.

The Town of Cottonwood and the surrounding area have excellent access to the freeway. Immediately south of town is the Bowman Road Interchange, the major portion of which was constructed under the previously described Unit No. 1 project. Just west of town is the Fourth Street Interchange and to the north, the North Cottonwood Connection. There is also an overcrossing at First Street.

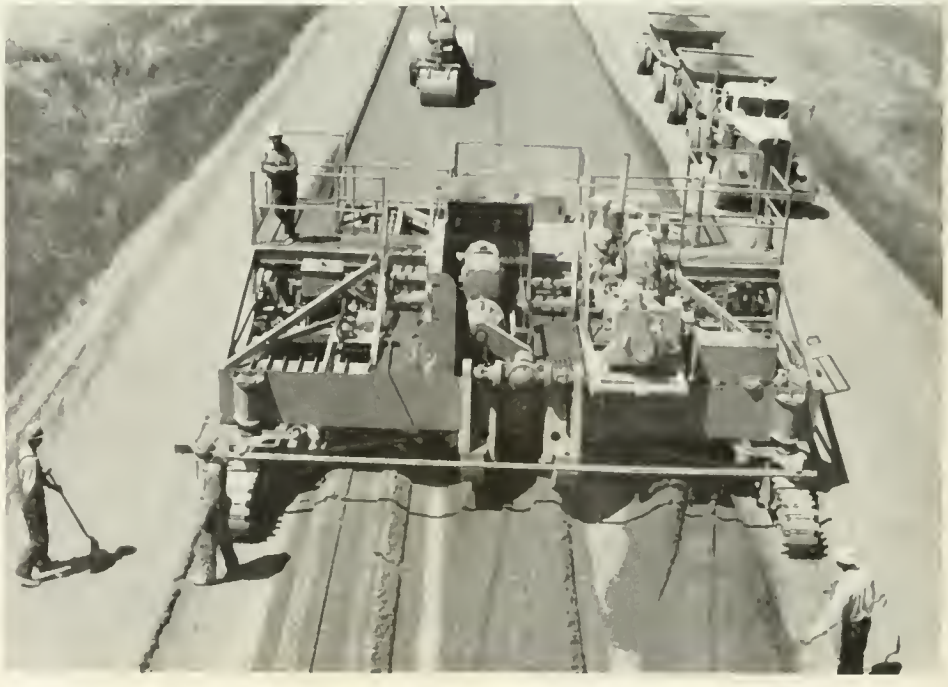
The cost of this project was approximately $2,900,000, nearly half of which was for structures. These consist of the First and Fourth Street Overcrossings, the North Cottonwood Undercrossing, and the Cottonwood Creek Bridge and Overhead. The Cottonwood Creek Bridge and Overhead consists of two parallel structures. The bridge for northbound traffic is 1,492 feet long and the southbound structure 1,339 feet long. Each of these two structures has three steel girder spans, which bridge the Southern Pacific Railroad right-of-way, and 15 and 13 reinforced concrete box girder spans respectively over the creek bed.

This is the third creek crossing to be built in this area. The first, built about 1920, was a concrete arch structure about 600 feet long located adjacent to the railroad bridge and partly under the new structures. This bridge was removed as a part of this contract. The second structure, on the former state highway and just downstream from the new crossing, will remain in service as part of the county road system.

Future Lanes

The new highway has an 84-foot median which makes it possible to add lanes in the future. The structural section is composed of selected material, aggregate subbase, eight inches of cement-treated base and five inches of asphalt concrete. Earthwork consisted of 460,000 cubic yards of roadway excavation and 300,000 tons of imported borrow. Few serious problems were encountered, although about 15,000 cubic yards of unsuitable material had to be removed from swampy areas within the Fourth Street Interchange. This was replaced with selected material from Cottonwood Creek to provide a firm foundation for the structural section.

The majority of the project was constructed without serious inconven-



A machine spreads the first of two four-inch lifts of cement treated base on northbound lanes of Interstate 5 north of Nine Mile Hill.

A series of these spillway checks were constructed in a 12-foot bottom channel near the south end of the project. Southbound lanes of the freeway are to the right.

ience to the traveling public. A series of temporary median crossings were used to carry traffic through the work at the south end of the project. Detours were provided for local traffic at First and Fourth Streets while the overcrossing structures were being built, and southbound traffic used the southbound off-ramp of the North Cottonwood connection while the main line was under construction in this area.

In order to maintain existing irrigation systems, several irrigation facilities were constructed. These included a 24-inch reinforced concrete pipe "siphon" in the vicinity of First Street and a 12'x7'x334' box culvert in the Anderson-Cottonwood Irrigation District Canal. In other utility work, an eight-inch water line and a three-inch gas main were placed in the Fourth Street Overcrossing to continue service to both sides of the freeway. Conduit for future water and sewer lines was placed under the freeway in the vicinity of Crowley Gulch by the Cottonwood Water District to provide for anticipated growth in the area.

Work was started on the project on August 2, 1962, with major emphasis on the Cottonwood Creek structures. By the time high water began to hamper the work, the majority of the footings and piers were in place. Also about 80 percent of the grading had been completed when operations were halted by bad weather.

The structures were completed in 1963. Paving was completed in the spring of 1964 and other items were completed by midsummer.

The contract was awarded to Stolte, Inc., and Lee Stephens, a joint venture, on August 2, 1962, and work was completed on August 6, 1964. Base and surfacing were done by Morgan Construction Company and by Ransome Company, subcontractors. Paul Gatschet, of Stolte, Inc., was project manager; E. B. Delano and R. W. Wenham were resident engineers; and N. E. Spicklemire was Bridge Department representative.

ABOVE: Long Span Prize Winner—COLD SPRING CANYON BRIDGE near Santa Barbara . . . Jurors' Comment: "A steel arch. Very simply and directly handled. The integration of the arch and approaches is very well done. There is a beautiful use of steel: integrated, lightweight, but still a long span. It fits beautifully into the site and is an economical bridge."

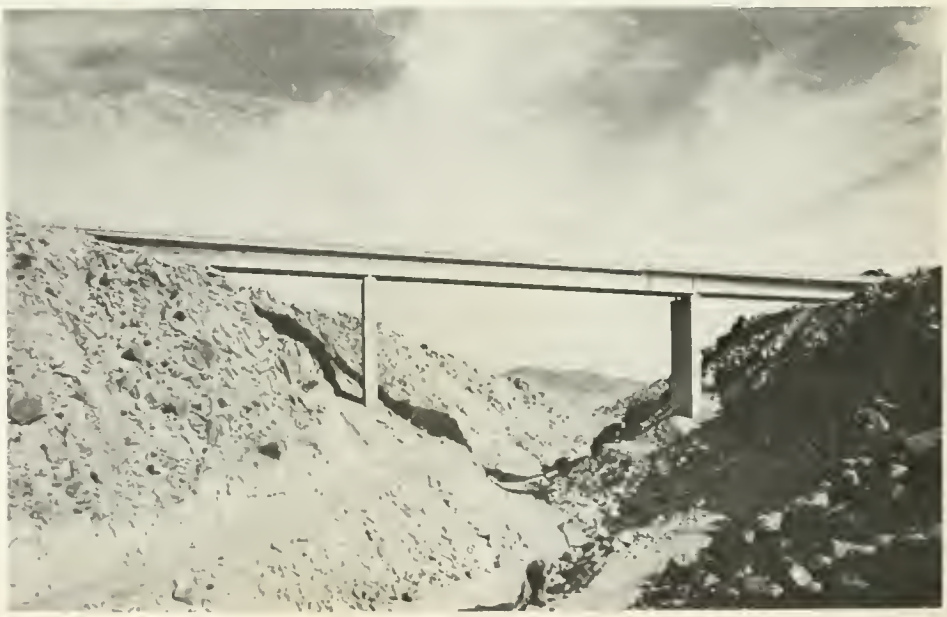
AWARD WINNING

California Steel Structures Take Four A.I.S.C. Prizes

California bridges took two of the top prizes in the annual prize bridge competition sponsored by the American Institute of Steel Construction for steel bridges opened to traffic between January 1, 1963, and October 10, 1964. Two others, also designed by the Division of Highways Bridge Department, were among 16 steel bridges receiving "Awards of Merit" in the national competition which drew 135 entries.

Cold Spring Canyon Bridge on Route 154 in Santa Barbara County was named the most beautiful long span bridge. Entries in this class were bridges with one or more spans of over 400 feet. This bridge, and its designer Marvin A. Schulman, associate bridge engineer, had been honored previously by the James F. Lincoln Foundation for progress in welded steel design (see September–October 1964 issue).

Winner in the short span prize bridge classification was Devil's Canyon Bridge No. 2, located five miles east of the San Diego county line on US 80 (Interstate 8). This bridge, designed by W. A. Behrens, senior bridge engineer (now with the Division of Bay Toll Crossings), was judged most beautiful of steel bridges with fixed spans and costing less than $500,000.



AT RIGHT: Short Span Prize Winner—DEVIL'S CANYON BRIDGE NO. 2 east of San Diego . . . Jurors' Comment: "Done in rather complete, harsh simplicity, fitting in with the country around it. It is a graceful structure using straight cantilever beams. The approaches are nice and look solid. We particularly like the proportionate simplicity of the piers holding the spans of this fine bridge."

CONTEST JURORS

WALDO G. BOWMAN, President, American Society of Civil Engineers, 1963–64; Publisher, *Engineering News-Record*

J. ROY CARROLL, JR., President, American Institute of Architects, 1963–64; Partner, Carroll, Grisdale and Van Alen, Architects

ROBERT L. DURHAM, Director, American Institute of Architects, 1963–64; a principal in the firm of Durham, Anderson and Freed

JON W. HAUSER, President, Industrial Designers Institute, 1963–64; President, Jon W. Hauser, Inc.

HENRY L. KAMPHOEFNER, President, Association of Collegiate Schools of Architecture, 1964–65; Dean, School of Design, North Carolina State College of Agriculture and Engineering

WILLIAM C. RENWICK, President, American Society of Industrial Designers, 1963–64; Design Director, Dow Corning Corporation

RONALD B. SMITH, President, American Society of Mechanical Engineers, 1963–64; Senior Vice President, M. W. Kellogg Company

KURT F. WENDT, President, American Society for Engineering Education, 1963–64; Dean of the College of Engineering, University of Wisconsin

EDWARD J. ZAGORSKI, President, Industrial Design Education Association, 1964–65; professor in charge of design program, University of Illinois

BRIDGES

Webber Creek Bridge on US 50 about 16 miles east of the Sacramento county line was one of five bridges in the medium span class receiving an Award of Merit from A.I.S.C.

The Vincent Thomas Bridge, linking San Pedro and Terminal Island, was one of four long span bridges receiving an "Award of Merit" from A.I.S.C. this year. And, the bridge across Webber Creek on US 50 near Placerville was one of five bridges in the medium span class which were selected for an "Award of Merit."

W. J. Jurkovich, senior bridge engineer, designed the Vincent Thomas Bridge, and A. P. Bezzone, senior bridge engineer, designed the Webber Creek Bridge.

The Vincent Thomas Bridge, which links San Pedro and Terminal Island, was one of four long span bridges chosen for an Award of Merit in the 1963–64 contest. There were 135 entries from all parts of the country.

In appraising the winners, the jurors agreed that bridge designers are taking advantage of the new steels as they are brought out by industry. "The current quality of bridge design," the jury said, "is very good. Bridges are getting better looking, as well as more economical. There is an obvious attempt on the part of the designers in this competition to do something about appearance. The winners all show that a great many types of bridges can be designed beautifully and harmoniously in steel."

The jury announced that "they are streamlining bridges more than they have before." In their criticism, they said that in some cases "the main part of the bridge often ends abruptly before the road has reached land again. The extremities are thinly or lightly done and don't seem to integrate as a total design."

Stainless steel plaques will be affixed to the winning bridges as a permanent tribute to their designers for combining aesthetics and utility, and award certificates will be distributed.

I-80 Over Donner Summit

By H. F. SHERWOOD, Assistant District Engineer

(Editor's note: The author, "Bill" Sherwood, headed both the planning and design of the high Sierra sections of Interstate 80 described in this article, and "walked the line in '52.")

When the final three sections of Interstate 80 freeway in the upper reaches of the Sierra Nevada Range were opened to traffic October and November 1964, the last of the 40-year-old, narrow, two-lane road was bypassed on this historic 115-mile route between Sacramento and the Nevada state line.

Formerly US 40, this heavily traveled portion of one of the nation's best-known intercontinental highways has been under construction since 1956 as part of the interstate system, financed mainly by federal tax funds. However, conversion to freeway standards began as early as 1947 in the Sacramento area.

This aerial taken from above Donner Summit looks northeastward across the old highway (foreground) to the new section of I-80 freeway. The old bridge and vista point can be seen in left foreground.

The opening of the 10½-mile climb over the formidable Sierra wraps up more than $100,000,000 in construction.

For the future, several projects remain to convert a section of expressway to freeway and to widen the existing freeway to six and eight lanes in the valley and foothill region between Sacramento and northeast of Auburn.

Earlier Reports

Detailed reports on earlier Interstate 80 construction were published in *California Highways and Public Works* for May–June 1955; May–June and September–October 1956; May–June, July–August, and November–December 1957; November–December 1959; January–February 1962; and March–April 1963.

This route, in use for 120 years, has often been a fierce challenge to the traveler. Its awesome grandeur and natural beauty are offset by a rigorous climate and rugged terrain.

The Donner Pass, if it can be called a pass—for the eastern face of the Sierra Nevada Range is really an escarpment formed by an ancient geological upheaval—was first penetrated by white men in 1844–45. The Indians wouldn't have much to do with it.

Excerpts from one historical account give a brief sketch of what these pioneers surmounted:

"The main body of emigrants took the wagons along the stream now called Donner Creek. Others went ahead with six wagons. They worked their way for two miles along the north shore of the lake (Donner). A quarter-mile beyond the head of the lake they must have made a halt and what they saw ahead was enough to appall anyone. A thousand feet high . . . so steep that little streams came leaping down in cascades, a rugged granite mass blocked the way. All the wagons were unloaded . . . chains were fastened to the tongues of the wagons and carried to the top of the rock where cattle were hitched to them. Then the men lifted at the wagons, while the cattle pulled at the chains and by this ingenious device the vehicles were all, one by one, lifted across the barrier."

A section of the old Donner road, graded in 1923 and 1924, showing the rocky terrain. Asphalt surfacing was placed in the 1930's. Later, turnout and passing lanes were added.

Cold Stream Route

In the following few years, Argonauts used the Cold Stream route south of Donner Lake, which was not quite so rough, but bad enough.

The tragic fate of the Donner party in 1846 was further testimony to the fearsomeness of this part of the Sierra.

But a rocky wagon road was gradually hacked around the boulders and, following selection of this pass as a railroad route, it was opened as a toll road from the railhead at Clipper Gap, near Applegate, to Virginia City. It was used heavily for about five years. However, completion of the railroad threw it into virtual disuse for the next 40 years.

The automobile began to exert its initial influence at the turn of the century, and in 1909 the State Legislature voted funds for the road's improvement.

But little was done until 1923 when a new line was developed north of the original road, once again along the north shore of the lake. In the 1930's it was paved. Turnout and passing lanes were added. Other relocations followed on the west side of the summit.

It is this route that has now been bypassed or wiped out by the spectacular new Interstate 80 freeway.

Actually, a few traces of the original pioneer road are still visible, especially in the Cisco Grove area and near the foot of the old Donner Grade.

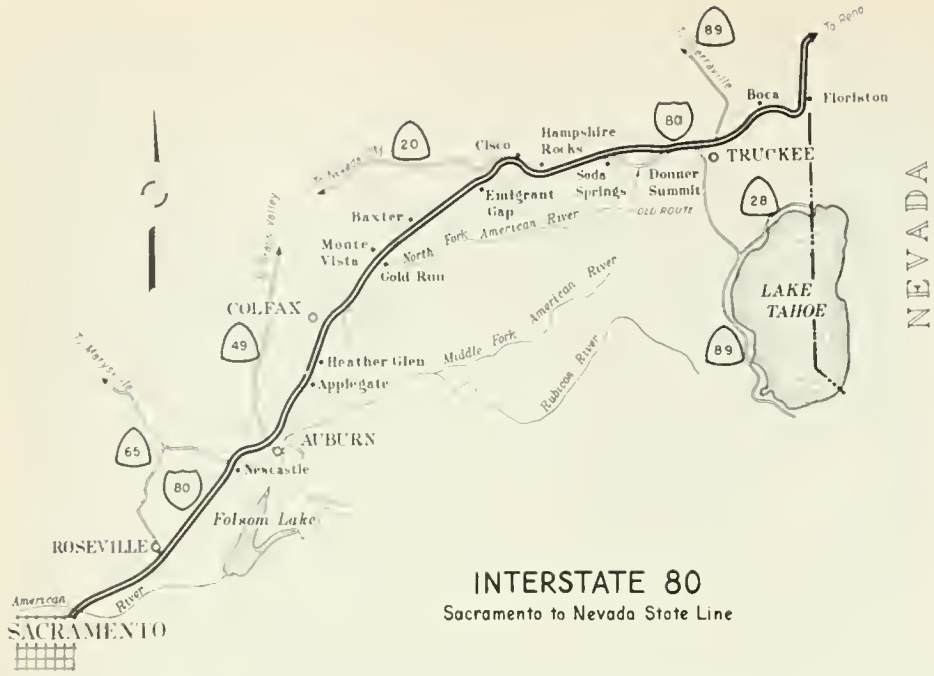
First Auto Trip

According to one newspaper report, the first auto trip over the summit and return was accomplished by a car dealer in the early 1920's. From Auburn to the summit took two days.

It was in 1931 that the state first undertook snow removal operations in an effort to keep the road open all year. Previously, of course, it was blocked every winter.

The new summit freeway design will eliminate many winter traffic tieups and delays—in fact already has—such as those caused by skidding vehicles, jackknifing truck-trailers and by vehicles unable to move after stopping.

To further minimize snow removal difficulties, flat cut slopes in drift



A map showing the location of the now continuous 115-mile freeway and expressway route from Sacramento to the Nevada state line.

areas are used with sufficient right-of-way and median width to permit at least a 100-foot throw either right or left of both sets of lanes.

Nevertheless, some traffic delays due to closures can be expected—and have occurred—because of zero visibility during blizzards.

Even though the district's experienced snow removal crews may be able to maintain a passageway to reach and clear drifts, it is sometimes necessary to stop traffic until visibility permits safe driving.

Under severe conditions, such as those experienced last November and during the holiday season, visibility becomes so bad that even the rotary plow operators cannot see to complete their work.

Included in Scenic System

This dramatic route has been included in the recently created scenic highway system and will continue to receive priority treatment in retaining its natural environment and inherent beauty.

To recap the final three construction projects—they totaled some 22½ miles at a construction cost of $25,500,000.

The 12 miles between Emigrant Gap and Hampshire Rocks (see map) was built under two contracts. The 5½-mile section from Emigrant Gap to the junction of State Highway 20 was completed October 2 by Guy F. Atkinson Co. at a cost of $8,700,000.

The adjoining Cisco Grove project, from the Highway 20 interchange to Hampshire Rocks, was finished November 11 by the joint venture firm of Fredrickson & Watson, Granite

PHOTO BELOW, LEFT—Emigrant Gap on new Interstate 80 looking east. The observation point (foreground) overlooks Bear Valley. It was at this site that Forty-niners dropped their wagons by rope to the valley (left). Highway design engineers had to solve a complex problem here, where room had to be found along a narrow mountain ridge to accommodate the old highway, the new freeway, utility lines and a double set of railroad tracks. To accomplish this they reduced the median width and built a concrete tunnel for trains which underposses the freeway (lower center). PHOTO RIGHT—An aerial, looking west, of the new summit area of I-80 in the vicinity of West Lakes. Rest areas can be seen on each side of the freeway in the middleground.

This photo shows the unusual median on the new I-80 freeway in the Cisco Grove area (see story). The river is the South Yubo.

Aerial looking northeast from above Soda Springs. The old highway parolleling railroad (right) will remain in service as access to ski resorts.

Construction Co., and Briggs, Conley & Dennis & Son at cost of just over $12,000,000, the largest contract completed in District 3 to date.

The Emigrant Gap-Highway 20 job involved moving 2,500,000 cubic yards of roadway excavation, production of 487,000 tons of aggregate, placement of 35,000 square yards of cement concrete pavement, and construction of five reinforced concrete structures including interchanges east of Emigrant Gap, at Yuba Gap, and at Highway 20.

Glacial Deposit Furnishes Material

More than 80 percent of the excavation was drilled, blasted, and moved with shovels. Aggregate base and subbase, and the asphaltic concrete used for paving shoulders and ramps, was produced from a glacial deposit two miles south of the center of the project.

Approximately 75 percent of the concrete for the traveled way was placed with side forms and the remainder by the slipform method. Most of it, about 80 percent, was centrally mixed.

On the ridge at Emigrant Gap, at the site formerly occupied by Nyack Lodge, a vista point was built overlooking the lush Bear Valley below on the north. It was also near here that some of the earliest pioneers lowered their wagons over the sharp drop into the valley for the journey down the Bear River to Camp Far West near Wheatland, then on to Sutter's Fort.

Except for the short distance between Emigrant Gap and Carpenters Flat, one or the other set of opposing lanes overlapped the old road.

Construction procedure was to build one set of lanes and switch two-way traffic onto them, so that motorists were using portions of the new highway most of the length of the contract.

On a two-mile eastbound section east of Carpenters Flat, a third lane was added to the upgrade for trucks and other slow-moving vehicles.

Eastbound Lanes Built First

On the adjoining Highway 20-Hampshire Rocks job, the eastbound lanes were built first and the westerly 4½ miles were opened to two-way traffic in September 1963, the remainder in September 1964. Westbound lanes were opened and the entire 6.8 miles were put into full operation on October 21.

Most of the 2,225,000 cubic yards of roadway excavation here was granite, granodiorite, and quartzite. Blasts of up to 10 tons of powder were not uncommon in the reduction of rock for removal by 2½- to 5-cubic-yard buckets.

Aggregate base and subbase were hauled an average of 20 miles, a portion of the haul route being the old Donner Grade. The slipform technique was used throughout and excellent riding qualities were obtained.

Fifteen bridges were built. For access to residential and recreational areas, interchanges were located at Indian Springs Road, Cisco Grove, and Hampshire Rocks. A major portion of the old road was preserved for access to summer homes and year-round recreational facilities.

Opposing lanes are actually independent roadways with varying hori-

Seattle Public Library
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zontal and vertical alignments. Median width ranges to over 1,000 feet at one point in the Yuba River canyon where unique conditions dictated not only that the river flow between the lanes, but that the frontage road and even private property be located there.

Section Is Washed Out

An unexpected additional construction project occurred in 1963 when, along with several other Sierra Nevada rivers, the South Yuba flooded January 21 under an unusual combination of weather and ground conditions. About 1,300 feet of the then-in-use US 40 near the middle of the project washed out. Extensive pavement and shoulder damage also occurred at numerous locations along the easterly four miles of the job.

With the immediately availability of the contractor's men and equipment and state engineers, and by dint of a feverish around-the-clock operation, old US 40 was restored and reopened on February 7.

This project took three construction seasons to complete, and the Emigrant Gap-Highway 20 job, four —still another testimony to the rugged nature of the high Sierra terrain where weather conditions permit only about 100 working days a year, approximately June through November —in a good year.

The new Donner Summit freeway was opened to traffic November 20 after a massive snow removal job following early and unexpectedly heavy snows and wind at the beginning of the month. Scheduled ribbon-cutting ceremonies November 1 were swamped by a snowstorm.

Actually, the project is 94 percent complete and final details will be completed this summer.

Roughly 10½ miles in length, this section was built under three contracts which will total about $15,000,000. The first two were for major excavation, grading, and structures on the east and west slopes. The third was mainly for base and surfacing.

Runs North of Old Road

The project begins its 3½-mile ascent just west of Soda Springs on an alignment that, at its farthest point, runs nearly two miles north of the old road and peaks at elevation 7,239, over 100 feet higher than the former route.

After a nearly flat crossing of the summit in the West Lakes area, the split-level new route begins its seven-mile descent into the Truckee Valley on grades varying from 1½ to 6 percent, to an elevation of 5,920 feet near the east end of Donner Lake in the vicinity of one of the presumed campsites of the Donner party.

Maximum upgrade is 5 percent.

Grading was completed in 1963, and a total of four million cubic yards was excavated under the two contracts and placed in embankment, the largest of which is 130 feet high and contains nearly 600,000 cubic yards of granite and andesite blasted from the highway path.

An embankment unique for a mountain highway was built just east of the new summit where it was necessary to pass the eastbound alignment through the north end of an eight-acre glacial cirque. It was set by the mud displacement method commonly used in crossing tidal flats.

At the east end of this fill, a dike had to be built on either side of the embankment and an impervious cutoff constructed below the level of the roadway prism, as well as in the fill itself, since from this point east the road begins dropping on a 6 percent grade below the mean lake level.

Streambed Relocated

It was also necessary to relocate the streambed of the creek which flowed from this small lake because the east-

The freeway roadways as seen from the Yuba Gap overcrossing. Blizzards with zero visibility conditions had made it necessary to close the freeway for a short time a few days before.

The eastbound roadway and frontage road shortly after they had been cleared of heavy snow near Donner Summit. The westbound lane is visible part way up the slope to the right.

A typical winter traffic queue on the old highway about one mile west of Donner Summit.

Graders remove snow after the big storm of 1952 on the old Donner Grade about halfway up the east slope near Big Shot.

bound alignment followed the creek channel for about 800 feet to a point below a 30-foot waterfall.

At first glance the nature of the country, mostly granite and andesite, might indicate that little trouble would be encountered with subsurface drainage. However, due to snow melt percolating into pockets of decomposed granite and glacial till, it was necessary to use 37,000 feet of perforated metal pipe to prevent ground water and seepage from damaging the roadway.

This was nearly twice the linear footage of pipe needed to handle surface runoff.

The eight-inch cement concrete slab for the traveled way was placed on four inches of cement-treated base and 12 inches of aggregate sub-base by a slipform paver. All downgrades were paved a standard 24-foot width. A 36-foot slab was poured on maximum 5-percent uphill grades to provide an extra lane with 3-percent maximum superelevation for slow, heavy vehicles.

A total of 135,726 barrels of cement were used, of which 117,000 were converted into 336,690 square yards of concrete paving—nearly 70 acres.

Six Major Structures

Six major structures were built. Three are reinforced concrete bridges, two composite, and one is a 15′ x 15′ reinforced concrete box culvert which carries the South Yuba under the highway near the west end of the project.

The longest and highest is the composite bridge for the westbound lanes of the Donner Lake interchange which serves the business and residential area at the foot of the Sierra around the western end of Donner Lake. It is 273 feet long, provides a roadway width of 51 feet, and is 64 feet above the undercrossing road which runs down to connect with the old highway on the lakeshore. It is 490 feet above the lake while the old route directly below is only 12 feet above mean lake level and just beginning its westerly circuitous climb up the forbidding Sierra.

Contractor for the base and paving contract was the joint venture of R. A. Westbrook, Inc., and Morrison-Knudsen Co.

Lee Hawkes was resident engineer. Construction engineer was Don M. Young.

For the Emigrant Gap-Highway 20 job, Hal Lopez was resident engineer. On the next-door Cisco Grove project, the resident was K. C. Jones. Don Hislop was construction engineer for both.

E. L. Miller was assistant district engineer—operations.

District engineer during most of the construction was Alan S. Hart, now head of District 4 (San Francisco). He was succeeded in District 3 by W. L. Warren in July 1964.

Several Projects Remain

Although the tough and exacting jobs of planning, designing, and construction in punching a modern highway over the once-impossible Sierra have been nearly completed, several projects yet remain to bring the entire Sacramento-Nevada line route to full interstate standards.

Finished in 1956, before the federal interstate program went into effect, the 13 miles from Auburn northeast to Illinoistown, near Colfax, is an expressway requiring 12 interchanges to eliminate grade crossings.

Bids were opened February 17 for interchanges at Heather Glenn and Illinoistown, which will add nearly six miles of freeway to this section since there is already one at Weimar, located between these two sites. The other locations will be built as funds become available in the next few years.

Also, as part of the interstate program, the existing freeway between Sacramento and the vicinity of Colfax will be widened to six and eight lanes.

In January, a public hearing was held by the district to present studies for a proposed additional eight-lane freeway in the corridor between the American River and Del Paso Park—an eight-mile stretch in the northeastern Sacramento area. The proposal will be presented to the California Highway Commission later this year.

I-80 in Solano County

By HERMAN R. JENTZEN, Resident Engineer

Interstate 80 (formerly US 40) is one of the transcontinental highways of a nationwide system scheduled to be completed by 1972.

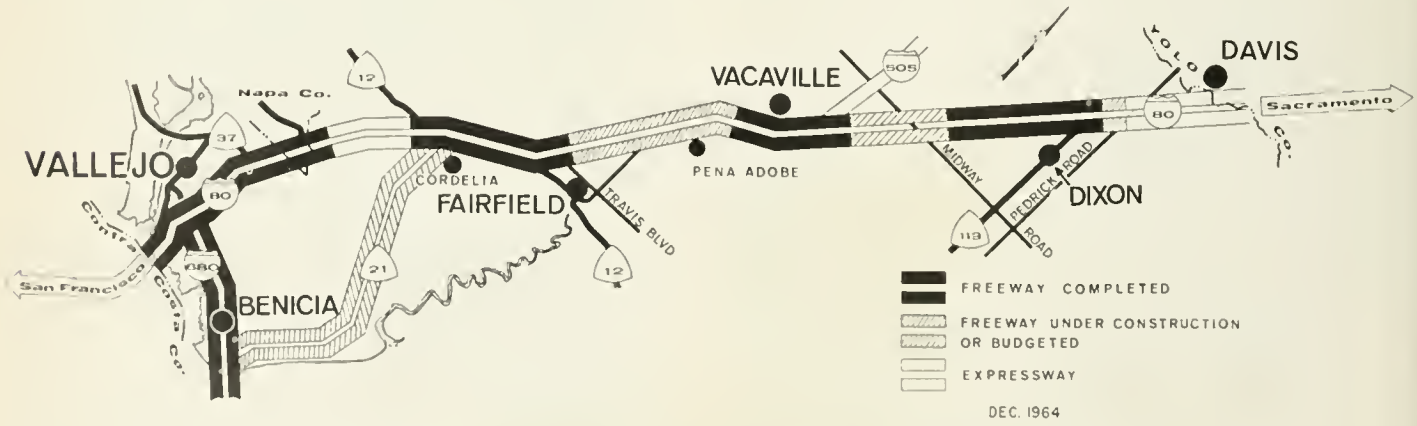
This heavily traveled road traverses the entire width of the state, a distance of 210 miles, from San Francisco to the Nevada state line just west of Reno.

All of the 44-mile section of Interstate 80 in Solano County is located in District 10. When the last of the three projects currently under construction is completed in October, the district will be more than 80 percent through its schedule of meeting the 1972 interstate deadline.

This route is of historical importance, since it was traveled by thousands of Forty-niners in settling California. It was first surveyed for a wagon road in 1860 and its development since then has been relatively continuous. It became a part of the state highway system when it was established in 1912. The original paving of this road in Solano County began in 1914 and was completed in 1917.

Looking east on Interstate 80 (then US 40; this photo was taken in 1943) toward the signolized intersection at Benicia Road in Vallejo.

Interstate 80 traffic now speeds solely toward Sacramento over Interstate 680 (foreground) and under Benicia Road (background) near Cordelia.



This map shows current construction status of Interstate 80 through Solano County.

Interstate 80 traffic heads toward San Francisco under Green Valley Road near Cordelia.

Traffic to Travis Air Force Base near Fairfield now travels over Interstate 80 on the overcrossings at Travis Boulevard (foregound) and the Air Base Parkway, farther north.

Looking east toward the Nut Tree on the left of Interstate 80.

In 1937 looking toward Vacaville, formerly Route 7 and which twisted through Vaca Valley, has been realigned and reconstructed as Interstate 80 freeway.

The site of the Pena Adobe built in 1842 by the Pena-Vaca families on Rancho Los Putos. Interstate 80 is to the left of the photo.

Portions of the original pavement laid in 1914 are still in service on the old two-lane road, known then as Route 7, in the vicinity of Cordelia. No major realignment or grading work was performed on this section of highway for about 15 years, however, efficient maintenance kept it in good condition.

Between 1932 and 1940, major improvements continued with an emphasis toward realignment. About $7,200,000 was spent between 1941 and 1956 to convert Interstate 80 from a two-lane road to four-lane expressway standards. Since 1957, construction has been accelerated to convert this interstate highway from expressway to full freeway standards, with all construction providing for an ultimate six or eight traffic lanes.

Since the last progress report on Interstate 80 in Solano County (in the May–June 1963 issue of *California Highways and Public Works*), two contracts have been completed, adding 13.9 miles of full freeway at a cost of about $8,500,000. Three more construction contracts totaling approximately $8,300,000 are currently in progress and their completion will add another 12 miles of full freeway.

Dixon Project

The first of the two recently completed contracts consisted of widening seven miles of the existing four-lane divided highway to six lanes, between Midway Road and a mile east of the Sign Route 113 interchange, near the Milk Farm Restaurant, about two miles north of Dixon.

This project was awarded to Frederickson and Watson Construction Company in January 1962, and was completed in December 1963 at a cost of $2,600,000. Merle Larrabee was the resident engineer for the state. The 1965–66 fiscal year budget contains $70,000 to install functional planting and trees along this section.

Vacaville Project

Last October the other contract was completed. This project converted an existing four-lane divided highway to a six-lane freeway, for a distance of five miles between two miles southwest of the City of Vacaville and one mile northeast of the junction with In-

terstate 505, near the Nut Tree Restaurant.

This project required the construction of 17 major structures and related frontage roads with the necessary connecting ramps. Completion of this project eliminated two railroad grade crossings and several at-grade intersections.

The major problem encountered during construction was providing adequate pavement area for the 30,000 vehicles which use this highway daily.

Eight detours were constructed during the various stages of this project. It was even found necessary on one occasion to provide a temporary detour in order to construct a primary detour. These items alone cost $80,000.

A new highly efficient slipform paving method expedited the completion of a major portion of the concrete paving. A Guntert and Zimmerman slipform paver placed both a 24-foot and a 36-foot pavement in one pass while automatically installing tie bars at 30-inch intervals and placing a plastic strip to form the longitudinal weakened plane joints.

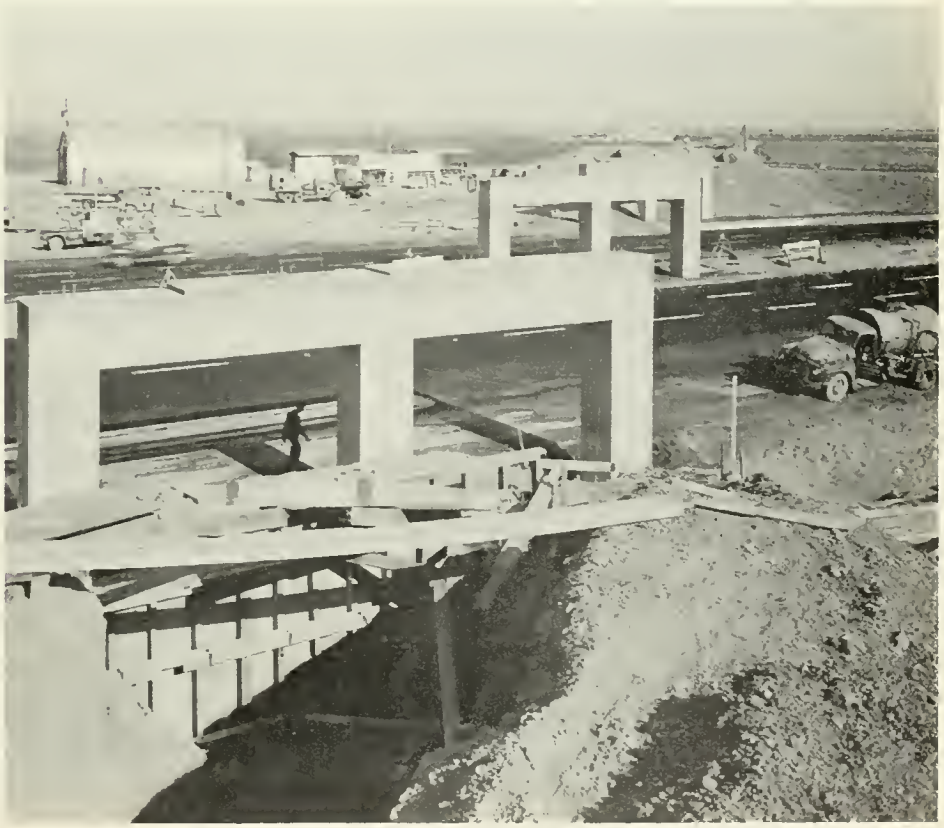
This project was awarded in November 1961 to Gordon H. Ball and Syar and Harms, and was completed at a total cost of $5.73 million. The state engineers for the project were G. W. Thompson, Bridge Department representative, and the author was the resident engineer.

The 1965–66 fiscal year budget also allocated $100,000 to install functional planting and trees along 4.4 miles of this project. It is anticipated that this contract will be advertised for bids in the spring.

Fairfield to Vacaville

Last July, work began on an estimated $5,300,000 project to convert another section of Interstate 80 from a four-lane expressway to a full freeway for a distance of 7.1 miles from the Travis Boulevard Overcrossing in Fairfield to Vacaville. This project, which is approximately 30 percent complete, also includes the reconstruction of the Air Base Parkway Overcrossing and the construction of interchanges at the intersection of Texas Street, Cherry Glen and Pleasants Valley Roads.

Construction on Interstate 80. The dirt fill (middleground) is the Meridian Road overcrossing. In the background is the P.G. & E.'s Vacaville substation.



The substructure of the Pedrick Road overcrossing near Dixon on Interstate 80.

An unusual feature of this project was the necessary relocation of a small private cemetery which dated back to the Mexican occupation and contained the graves of several Solano County pioneers. This cemetery was relocated near the Peña Adobe, a California historical landmark about two miles south of Vacaville adjacent to Interstate 80. This historical landmark identifies the site where an adobe house was constructed in 1842, by the Peña-Vaca families on Rancho Los Putos, and acknowledges the establishment of the "Town of Vacaville" in 1851.

This construction project was awarded last June to Gordon H. Ball and Syar and Harms and it is anticipated that construction will be completed in December 1965. Jerry A. Hanto is the state's resident engineer.

This grade separation carries Dixon-Grant Road traffic over Interstate 80.

Vacaville to Dixon

Construction also began last July on another project for freeway conversion, extending 3.7 miles between one mile east of the junction with Interstate 505 and the Midway Road Overcrossing. Two concrete lanes will be added to the existing four-lane divided highway to provide six lanes of traveled way. This project also includes the construction of frontage roads; interchanges at Leisure Town, Meridian and Midway Roads; and a bridge at Gibson Canyon Creek.

This project, also about 30 percent complete, was awarded to Gordon H. Ball and Syar and Harms last August and should be completed in September at an estimated cost of $2,200,000. William F. Birt is resident engineer for the state.

When Interstate 80 is widened near the Yolo County Line, this at-grade intersection adjacent to the University of California Davis campus will be eliminated.

Pedrick Road

The third project under construction consists of converting about one mile of four-lane expressway to a six-lane freeway and the building of an interchange at Pedrick Road, where an at-grade intersection had been the scene of numerous fatal accidents. Construction of this interchange is almost complete.

This project was awarded to the Granite Construction Company last May and the estimated cost of construction is $792,000. William H. Gilmore is the resident engineer.

Future Planning

The remaining two sections of the 8.2 miles of expressway to be converted to full freeway standards in Solano County, before 1972, are in the planning and design stages. One section extends 3.9 miles from the Napa County line to the junction of Sign Route 12 in the vicinity of Cordelia. The other section runs from Pedrick Road to the Yolo county line, a distance of 4.3 miles. The estimated total cost for the completion of these projects is approximately $10,000,000.

Vista to Escondido

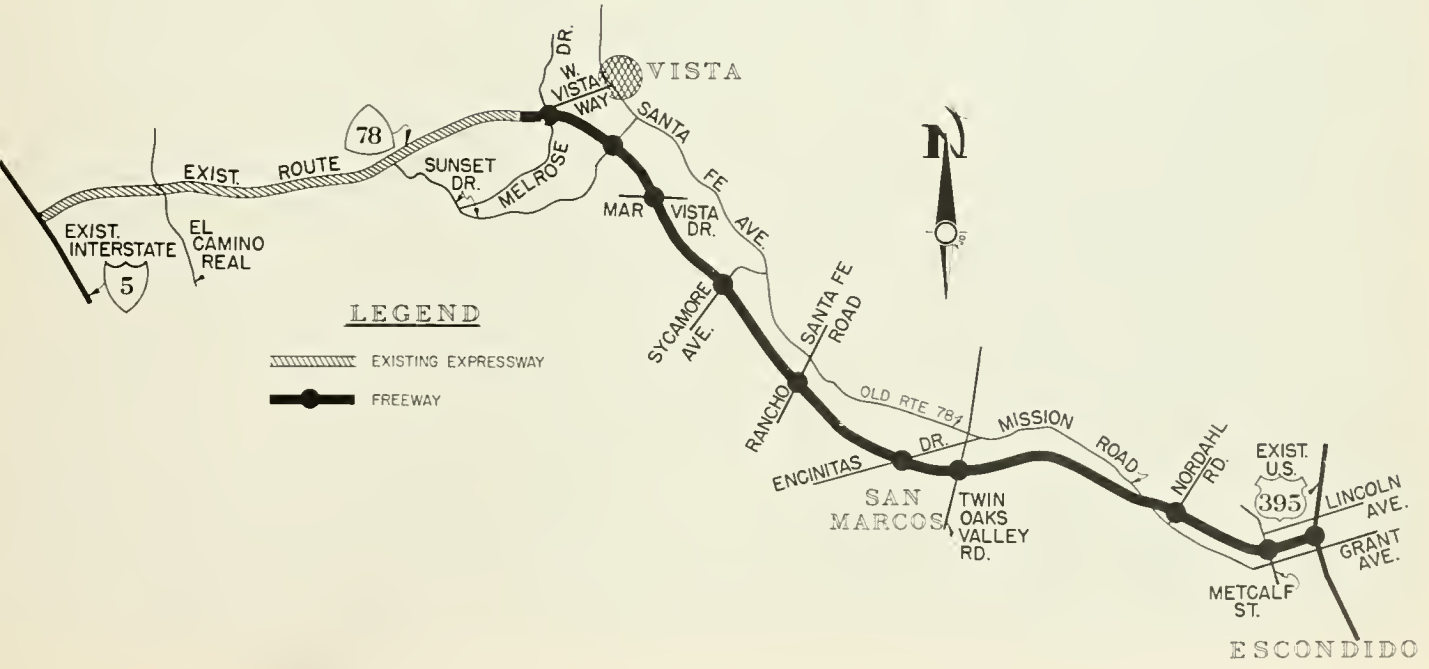
Key Route 78 Link Completed In South

By M. A. CHASE, District Design Engineer

In December 1964, the final freeway link between Vista and Escondido was completed. A dedication ceremony was held on the Metcalf Street Overcrossing in Escondido on December 21. This long-awaited event culminated approximately 10 years of planning and construction.

Freeway development through this area is acknowledged as a major contributing factor to the economic growth of the section. Until quite recently the area was mainly agricultural, noted for its large poultry ranches and dairies. The specifications for the first freeway construction unit even directed the contractor's attention to possible adverse effects on poultry caused by construction operations. Fortunately, there is no record of any.

The completed section of Route 78 Freeway looking east from the Mar Vista Overcrossing.



Looking south from Encinitas Road Undercrossing. Escondido is at the top of the picture. Large white buildings in upper right are a poultry ranch.

Other Developments

Roughly coinciding with freeway construction have been several other developments, two of which are the Lake San Marcos community and the expansion of Palomar Junior College. The Lake San Marcos development is a $12,000,000 residential and resort community built around an 80-acre manmade lake and an 18-hole golf course. Palomar Junior College has an enrollment of more than 2,000 students and is claimed by the San Marcos Chamber of Commerce to be California's fastest growing junior college. The college has achieved the distinction of being a landmark because of its geodesic-domed gymnasium which is visible for many miles.

Area Growth

A further indication of the growth of the area is typified by the increase in population of San Marcos from 518 in 1956 to 5,000 in 1961. The City of San Marcos was incorporated in 1963.

The total of 12.4 miles of four-lane full freeway between Melrose Drive in Vista and Route 395 in Escondido was constructed under three separate contracts at a total cost of $9,294,000. The V. R. Dennis Construction Company handled the first unit between Rancho Santa Fe Road and Nordahl Road. This 5.4-mile section was completed in April 1962 at a cost of $3,231,000. The second contract between 1.0 mile west of Vista and Rancho Santa Fe Road, a length of 5.1 miles, was completed in February 1963 at a cost of $4,199,000. The contractors were the Riha Construction Company and the C. W. McGrath Enterprises. The third and final section covers the 1.9 miles between Nordahl Road and Route 395. The contractor was Pentaco-Rados and the estimated construction cost $1,864,000.

All in Freeway System

All of Route 78, which extends from Route 5 in Oceanside to Route 10 near Blythe in Riverside County, is in the California freeway and expressway system. The section, however, between Vista and Escondido is the only part that has been completed to full freeway standards. Expansion to full freeway status of the expressway portion between Oceanside and Vista is now under study.

Underpasses Replaced

By P. C. WARRINER and W. T. EGLOFF, Associate Bridge Engineers

Two recent bridge construction projects in District 3 have replaced old, and long outmoded, railroad underpasses with new, modern structures. Construction was performed under two contracts, one on Route 20 in Marysville, and the other on Route 49 in Auburn.

These projects were similar in many respects. In each case a troublesome traffic problem was eliminated. The "bottleneck" in each case was an old railroad underpass which, although still structurally adequate, no longer accommodated highway traffic satisfactorily. Both projects were located in cities with rich histories. Each project required careful planning and construction, since Southern Pacific Company mainline tracks had to be shifted from old to new structures without interruption of heavy rail traffic.

EAST MARYSVILLE UNDERPASS

Route 20 leads east from Marysville toward the foothills and the cities of Grass Valley and Nevada City. This highway generally follows the route which has linked Marysville with the gold country for many years.

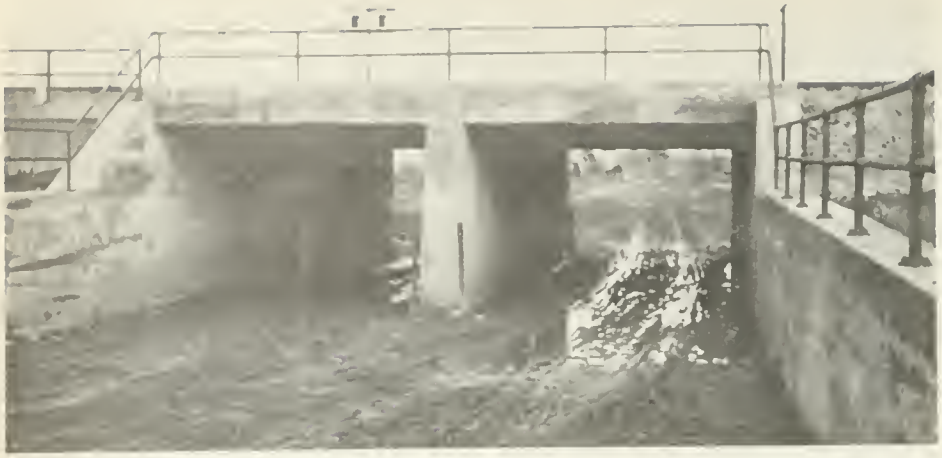
In East Marysville, the road to Grass Valley was, and still is, 12th Street. The first railroad in the area (originally the California Northern Railroad, it later became part of the Southern Pacific system) stretched from Marysville to Oroville and crossed 12th Street at A Street.

For many years the highway and railroad crossed at grade. In 1910 it was decided to elevate the railroad tracks in Marysville. Railroad forces constructed an underpass at 12th Street as a part of the project. The railroad bridge consisted of massive, unreinforced concrete abutments and center pier spanned with closely spaced, concrete-encased steel beams. The underpass provided 12th Street with two 15-foot roadways. Vertical clearance was 9 feet 11 inches. The structure, known as the East Marysville Underpass, was completed in 1911.

Included in State System

In 1933 the Grass Valley road and the East Marysville Underpass became a part of the state highway system. As highway traffic increased and vehicle size grew, the underpass gradually changed from an occasional nuisance to a notorious bottleneck and hazard. Truck traffic had to be routed over a

The new East Marysville Underpass on Route 20 carries four lanes of traffic under the Southern Pacific railroad tracks and has a vertical clearance of 15 feet 1 inch.



This Southern Pacific photo of the old East Marysville Underpass was taken shortly after its construction in 1911.

grade crossing on 10th Street. The underpass became the lowest in the state highway system. Local residents were well aware of the situation, but many "foreign" drivers failed to note impaired clearance signs and encountered a structure through which they could not pass.

The heart of the reconstruction plan was elimination of the railroad's existing switchyard, and its replacement north of the underpass site. The old switchyard had extended from 8th Street to north of 12th Street. Four tracks, two of which were switching tracks, had been carried by the old railroad bridge. Several city streets had grade crossings through the yard and switching frequently blocked traffic for long periods. Elimination of the old yard and its relocation produced the following desirable results:

1. The new railroad bridge could be designed to accommodate two rather than four tracks—so structure costs were greatly reduced.
2. Local city traffic would not be delayed by railroad switching operations (there are no city streets in the new yard area).
3. No expensive temporary shoofly construction was necessary, as the railroad was kept in service by a series of relatively simple track changes. The old bridge, because of the greater number of tracks, was much wider than its replacement. The extra width provided enough room to allow passage of rail traffic over a portion of the old bridge while the remainder of it was removed. The new structure was constructed in space provided by this removal.
4. Material obtained from the underpass excavation could be utilized to construct a portion of the new railroad switching area and thus did not have to be wasted.

The new structure consists of a riveted steel through plate girder bridge. It provides a vertical clearance of 15 feet 1 inch and a clear span over the four-lane highway. Reinforced concrete retaining walls form the sides of the underpass. The pavement is eight inches of concrete over cement-treated base. A pumping plant transports drainage water out of the depressed roadway.

Built in 15 Months

Construction of the new underpass was accomplished in approximately 15 months. A prearranged sequence of operations was necessary in order that rail, highway, and local traffic could be maintained at all times.

The first phase of construction work entailed building a part of the new railroad switching yard. When this yard was completed and in service, 12th Street was closed and Route 20 traffic detoured over the truck route on 10th Street. Rail traffic was then using only one track on the old bridge, the most easterly. A heavy steel sheet pile retaining wall was installed parallel to this track and as close to it as train safety permitted. The sheet pile wall kept the live track safely in place while the contractor removed the westerly two-thirds of the old bridge. The area inside the sheet pile wall was excavated to 26 feet below track elevation. The new structure was completed within the limited space afforded by the excavation, and rail traffic was routed onto the new bridge. Finally the remainder of the old bridge was demolished and the underpass walls and roadway on 12th Street were completed.

This photo of the old East Auburn Underpass is doted December 15, 1914. The view is eastword.

The new East Auburn Underpass is a two-span reinforced concrete box girder bridge over a four-lane highway. It was constructed on new alignment.

EAST AUBURN UNDERPASS

The East Auburn Underpass is located on Highway 49 in the City of Auburn, and carries the Southern Pacific Company westbound tracks over the highway.

Highway 49 is a scenic highway through the Mother Lode country and in this area runs from Grass Valley to the north through Auburn and to Placerville in the east. Auburn is a foothill or mountain city where the streets generally follow the path of least resistance and are randomly located.

The city is divided into several sections by the mountainous terrain, the Interstate 80 Freeway and the Southern Pacific Company railroad tracks. Highway 49 traffic plus all local traffic from the main business section of the city to the subdivisions and businesses to the east normally pass through the East Auburn Underpass. Traffic is heavy and much of it is truck traffic, including many logging trucks.

Was Traffic Battleneck

Because the existing underpass had a roadway width of only 18' 9", was on poor alignment and had heavily used cross streets on each side, it is not difficult to see that it was both dangerous and a traffic bottleneck. It had become a one-way street, with the drivers waiting at the entrance until opposing traffic had cleared before entering.

The history of the old road and underpass is rather obscure. The railroad fill at the site of the underpass was placed as part of the first transcontinental railroad by the Central Pacific Railroad Company under the supervision of Charles Crocker in 1865. Early traffic probably used the grade crossing at Forest Hill Avenue, just one block north of the underpass. This grade crossing, although in use until the new underpass was completed, was dangerous, being immediately adjacent to a railroad cut.

In 1905 the Southern Pacific Company constructed the underpass at its present site. This underpass consisted of granite rubble abutments with timber stringers to carry the tracks. Sometime around 1925 the timber stringers were replaced by steel girders. This structure remained in use until completion of the new underpass structure, when it was removed. It is interested to note that although these granite abutments were placed with very little mortar, the stones were so well seated that it became impractical to dislodge them with a large bulldozer and dynamite was used to separate them for removal.

Old Underpass Replaced

Last year the old underpass was replaced by a new modern structure and Highway 49 was widened to four lanes through the structure. The new underpass is a two-span reinforced concrete box girder bridge with reinforced concrete pier, abutments and wingwalls, all supported on steel bearing piles. It carries two tracks over the highway. This was the first reinforced concrete structure designed and constructed by the state to carry mainline railroad tracks.

To make this improvement with a minimum of interference to rail traffic, the new underpass was constructed on new alignment, and new fills were placed. Tracks were shifted to the new alignment, the existing underpass and fills were removed and the roadway under was constructed.

The new alignment for the railroad was so close to that of the existing one that construction of the new underpass did not proceed as simply as it had been planned. It was necessary to place shoring to maintain the existing railroad embankment before the excavation for the new structure could be completed. The contractor used sheet piling for this shoring. At the north abutment timber walers and braces were used. At the south abutment

steel walers were used with steel tension rod ties through the existing fill. Anchorage for these ties consisted of additional sheet piling set in place behind a low granite rubble wall. Backfill material capped with concrete was also placed behind these piles.

Southeast Wingwall

The southeast wingwall actually extended out into the existing mainline track and was designated on the plans as stage two construction, to be built after the tracks had been moved to the new structure. To have moved both tracks to the new structure simultaneously would have required that additional shoring be used to maintain the new fill while this wingwall was being constructed. With the permission of the Southern Pacific Company, the mainline track was moved to the new alignment, the wingwall was completed, backfill placed and then the siding track was moved to the new alignment.

Before work could begin on the underpass, it was necessary to provide a detour for traffic and relocate the Boardman Canal. This canal, owned by the P.G. & E. Company, supplies water to a large area below Auburn and can only be stopped for a few hours and then only during the slack season. The detour was provided by widening and paving existing city streets. As a part of the widening it was necessary to remove an old house and widen a culvert over Boardman Canal. The relocated canal consisted of a concrete-lined ditch on a fill, except at the widened Highway 49 where it consisted of a 48" reinforced concrete pipe siphon with reinforced concrete inlet and outlet structures.

* * *

Both the East Marysville Underpass and the East Auburn Underpass were constructed by A. Teichert & Son, Inc., contractor. The job superintendents were Ray Bertelsen in Marysville and Jack Malte in Auburn.

The East Marysville Underpass was completed at a cost of approximately $650,000. The East Auburn Underpass was completed at a cost of approximately $350,000. The major portion of the construction was financed with highway funds. The Southern Pacific Company participated in the cost at Marysville. The Southern Pacific Company, Placer County and the City of Auburn participated in the cost at Auburn.

Philip C. Warriner was the resident engineer and J. F. Loomis, the district representative on the Marysville contract. W. T. Egloff was resident engineer and Merl Coburn district representative on the Auburn contract.

STATE'S HIGHEST VALOR AWARD FOR FRED BOUCHER

PROUD FAMILY—They have reason to be proud of him—he has reason to be proud of them. On December 15 when Fred Boucher received his Medal of Valor Pin with Diamond, here's how the family lined up: from right to left, father Fred, his wife Dolly, and "down the scale" are Jim, Sue, Annette, Dawn and Joni. They stand ahead of the plaque on which are inscribed the names of employees who have been honored for acts of heroism extending above and beyond the call of duty.

The State of California's highest award—the Medal of Valor Pin with Diamond—was presented to Fred L. Boucher, District 3 highway engineering associate, by Governor Edmund G. Brown on December 15, following the Governor's press conference in his office.

In a heroic attempt to save the life of a man trapped in an overturned pickup truck on September 26, 1963, Boucher was hurled about 20 feet by an explosion. In addition to suffering numerous burns and lacerations, an eardrum was ruptured, a leg shattered, and an elbow dislocated. Boucher was en route to Coloma at the time, to inspect a construction project.

Ellis R. Lynn of Diamond Springs and Walter Hokanson of Placerville were presented with letters of appreciation by Governor Brown in recognition of their efforts at the accident scene. Hokanson was hospitalized for six days with burns, lacerations and eardrum rupture. Lynn was at a sufficient distance to escape injury, although he was knocked down by the explosion, and his clothes shredded.

Boucher was back at work as of November 12, 1963, after spending several weeks in a hospital, and several more weeks recuperating at his home in Fair Oaks. His wife and five children shared in the Medal of Valor presentation ceremony.

Donated Trees

Gift of Palms for Los Angeles Freeway

Seven palm trees ranging in height from 20 to 40 feet were donated by the Southern California Edison Company for planting on the San Diego Freeway near Manchester Avenue and Century Boulevard.

The palm trees, which lined Pacific Coast Highway between Western Avenue and Crenshaw Boulevard, were doomed for destruction because of interference with Edison's power lines. Rather than destroy them, the company offered to uproot the trees and move them to the nearby San Diego Freeway, where a Division of Highways landscaping project is in progress.

Valley M. Knudsen, president of Los Angeles Beautiful, praised the donation as "a contribution to community beauty by private enterprise which we hope will inspire others."

Five of the trees, all queen palms, are being placed at the freeway's interchange with Century Boulevard. The other two, both Mexican fan palms, will be planted at the Manchester Avenue interchange.

The $400,000 landscaping project runs from El Segundo Boulevard to La Tijera Boulevard and calls for placement of 1½ million ground cover plants, nearly 5,000 trees, and over 8,000 shrubs.

PHOTO ABOVE: Division of Highways maintenance men place one of the palms at the San Diego Freeway-Century Boulevard Interchange. PHOTO BELOW: A palm tree being transported down Pacific Coast Highway to the San Diego Freeway.

PHOTO BELOW: Looking over landscape plans (l. to r.) are Resident Engineer Harold Taahig, Division of Highways; Highway Engineer Forrest A. Norton, Bureau of Public Roads; C. E. Lee, line clearance supervisor, Southern California Edison Company; Mrs. Valley Knudsen, president, Los Angeles Beautiful; Landscape Architect James Gordan, Division of Highways.

Routes Adopted

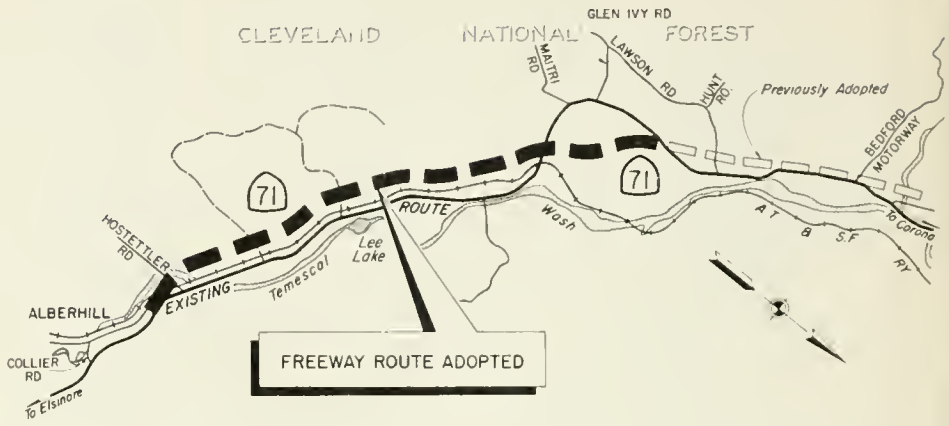
77 Miles of Freeway Located in Late 1964

The California Highway Commission adopted the locations for 77 miles of freeways on 10 routes at its September–December meetings.

Three of the route location studies generated sufficient local interest as to require public hearings by the commission itself. All of the route adoptions were preceded by public hearings conducted by the Division of Highways.

The most challenging task faced by the commission was the locating of three interconnected freeways in the South Pasadena–Pasadena–La Canada–Glendale and Tujunga-Sunland areas of Los Angeles County, the subject of a commission hearing in Pasadena on June 3 and 4, 1964.

The joint routing extends the Long Beach Freeway (now under construction between the San Bernardino Freeway and Valley Boulevard, and previously adopted to Huntington Drive in South Pasadena) four miles northerly to the adopted route for the Colorado Freeway in Pasadena; the Interstate 210 Freeway for 15.4 miles from this point to Wheatland Avenue in the Sunland area; and the Glendale Freeway four-tenths mile between Verdugo and Foothill Boulevards.



Starting at Huntington Drive, the newly adopted route continues northerly to interchange with the Pasadena and Colorado Freeways, swinging westerly just south of Devils Gate Dam and proceeding generally south of Foothill Boulevard through the Verdugo Mountains and across Big Tujunga Wash to Wheatland Avenue.

Another routing, in San Mateo County, was the subject of a commission hearing in Woodside last July 31. The commission adopted a 1.7-mile freeway location for Route 84 between the adopted route for the Interstate 280 Freeway and Santa Cruz Avenue in Menlo Park, following the general alignment of Sand Hill Road.

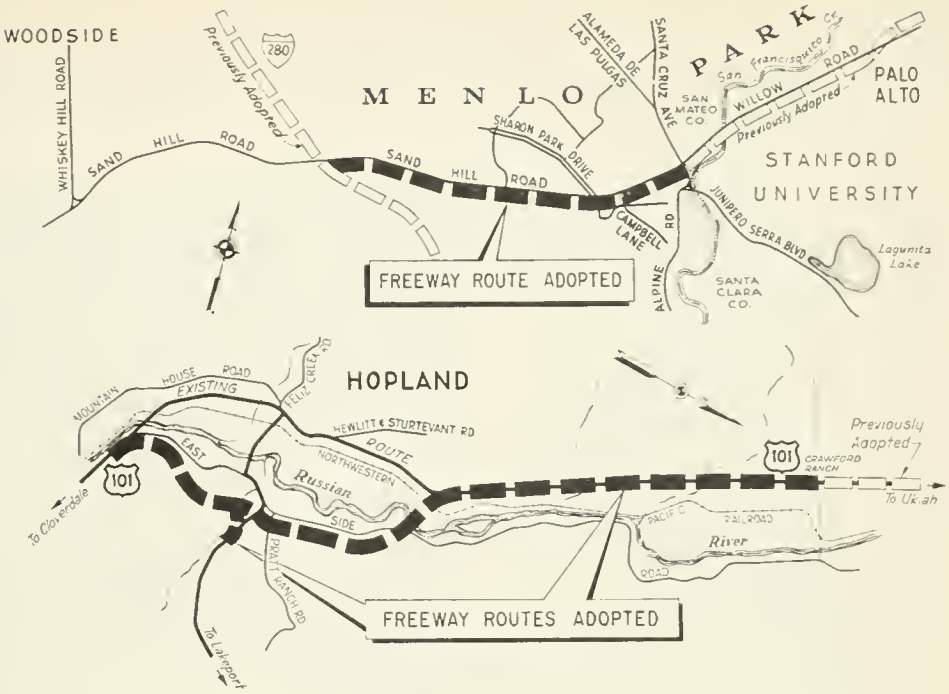
In the resolution of adoption, the commission specified that the design of this freeway must conform to guides approved by the state's Advisory Committee on a Master Plan for Scenic Highways.

The third commission hearing, held in Hopland in Mendocino County on March 12, concerned the adoption of

8.7 miles of US 101 between six-tenths mile south of the Hopland Overhead and Crawford Ranch, and a short connection between this route and Lakeport Road (Route 175).

The newly adopted routing runs east of the Russian River for about four miles, then crosses the river and rejoins the existing highway, following it to Crawford Ranch, where it connects with a previously adopted routing.

In San Diego County, the commission located two freeway stretches on Route 125. One is for approximately four miles between Interstate 8 in La Mesa and two-tenths mile south of Mission Gorge Road west of El Cajon. The second extends for 8.5 miles between four-tenths mile north of the Otay River and future Route 54 in the unincorporated community of Sunnyside.



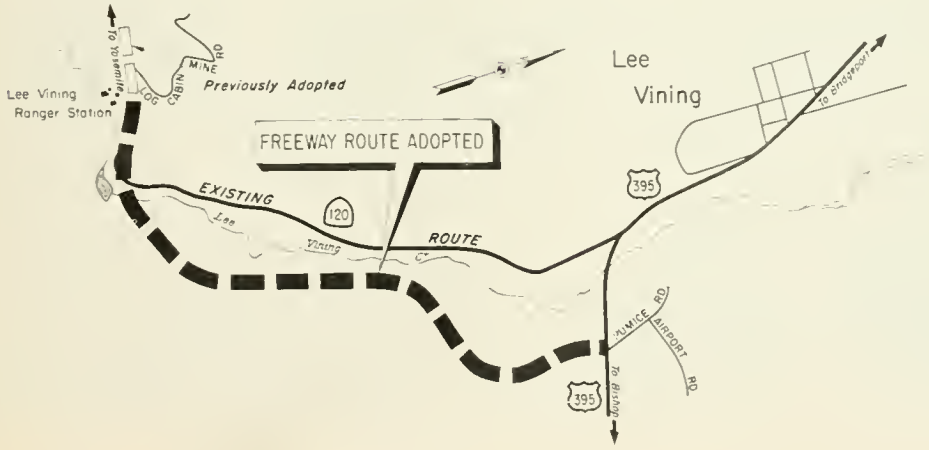
Two other route adoptions concerned Mono County, one on Route 120 (Tioga Pass Highway) and the other on US 395.

The newly adopted Route 120 extends 1.2 miles from the Lee Vining Ranger Station to a junction with US 395 southeast of Lee Vining. The 3.7-mile section of US 395 follows the general alignment of the existing highway between two-tenths mile south of Route 89 and the Nevada line.

In Ventura County, a 19.3-mile freeway routing for Route 118 was adopted between six-tenths mile west of La Vista Avenue near Saticoy and three-tenths mile east of First Street near Simi; also a 13.1-mile section of Route 23 between three miles south of Tierra Rejada Road and the adopted route for the Route 126 Freeway near Fillmore. The three-mile segment south of Tierra Rejada Road superseded a section adopted in November 1962.

Two route adoptions during the September–December period involved revision of previously adopted freeway routings in Riverside and Colusa Counties.

The revised routing in Riverside County affected 5.5 miles of Route 71 between 1 mile north of Alberhill and 5 miles south of Corona. The revision located the freeway south of the Atchison, Topeka & Santa Fe Railway tracks for most of its length.



The commission also revised its routing for 6.6 miles of a 14-6-mile section of Interstate 5 which was adopted in October 1962.

The revised segment is in Colusa County between Maxwell–Colusa Road east of Maxwell and 1 mile north of Delevan Road, approximately 1.5 miles south of the Glenn county line. The revision will cause the freeway to cross from the east to the west side of the existing highway north, rather than south, of Wadleigh Road. From this crossing, it will proceed northerly one-fifth mile west of, rather than adjacent to, the existing highway.

In other route actions, the commission adopted 4.1 miles of local roads and streets in the Monterey–Pacific Grove area as a new section of Route 68, extending between Route 1 at the Carmel Hill Interchange and Asilomar Beach State Park; adopted a new routing for US 40 traffic in Sacramento, employing the P and Q Streets one-way couplet between 5th and 15th Streets and 3rd and 16th Streets, pending completion of the Interstate 80 Freeway through the city; and relocated seven-tenths mile of Route 49 in the Bagby area of Mariposa County, as the existing highway will be inundated by the Exchequer Reservoir, now being enlarged by the Merced Irrigation District.

Foreign Visitors

French, Brazilian Officials Inspect State's Highways

Districts 7 (Los Angeles) and 4 (San Francisco) welcomed 150 engineers from all parts of France during September and 21 Brazilian highway engineers were guests of District 8 in San Bernardino in November.

The French visitors, most of whom represent various branches of the French government and are involved in public works activities of all kinds at home, arrived in Los Angeles directly from Paris, to begin a three-week tour of the United States which included inspection of freeways in Los Angeles and San Francisco.

Christian Gerondeau of the Ministry of Public Works and Transport, Paris, acted as advance spokesman for the group.

Following a September 9th visit to Disneyland, the French tour proceeded to San Francisco, from where they were to separate into five smaller groups, each moving eastward across the country, to meet again in Washington and New York and thence home.

The Brazilian engineers, sponsored by the Agency for International Development (AID), toured state and county highways in San Bernardino and Riverside Counties.

Aim of the visit was to observe techniques and methods used to design, construct and maintain two-lane rural secondary roads. Most of Brazil's highways are of this type.

C. V. Kane, District Engineer in San Bernardino, discusses a model of a structure with Luiz F. Moura (left) and P. F. Freitas (right), two of a group of 21 Brazilian highway engineers visiting the district.

Brazil hopes to build 3,000 miles of new highways while improving 8,000 miles of existing roadways.

Members of the study team included chief engineers of Brazil's highway agencies, two professors in soil mechanics and highway design, and a member of the Brazilian Highway Research Council.

The group departed for St. Louis in late November, and returned to Washington, D.C., during the first week in December as guests of the Bureau of Public Roads.

150 visiting French engineers pour out of their buses to photograph the view from the Santa Monica-San Diego Freeway Interchange, during their stay in Los Angeles.

Slipform Paving

New Process Brings Marked Cost Savings

By L. R. GILLIS, Assistant State Highway Engineer and
L. S. SPICKELMIRE, Assistant Construction Engineer

This report was first presented at the Highway Research Board symposium on slipform concrete paving at Washington, D.C., in January 1965.

In California, slipform paving has ow been used for five years, and dur- ıg this period an estimated 16,000,000 quare yards of pavement has been ipformed. Of the 6,000,000 square ards of concrete pavement placed in ach of the last several years more ıan 80 percent has been slipformed. 'his was irrespective of terrain, geo- ıetric features, location, or relative mportance of the highway routes in- olved.

All of our major paving contract- rs, except one, have now abandoned ıe use of sideforms in favor of slip- orm.

A situation occurred recently on ne of our interstate projects which ıay be illustrative. The contractor, aced with a last-minute hiatus in his lans for placing the 1,800,000 square ards of concrete pavement, was orced to decide on one of two pos- ible alternatives: (1) utilize two pav- ıg crews, working two 11-hour hifts, to slipform another job, then ıove the paver and work two 11- our shifts to pave the principal job; r (2) pave both jobs simultaneously, sing sideform equipment on the prin- ipal job. Even though he would be elayed two weeks, he selected the lipform alternative on the basis of es- imated savings in excess of $40,000.

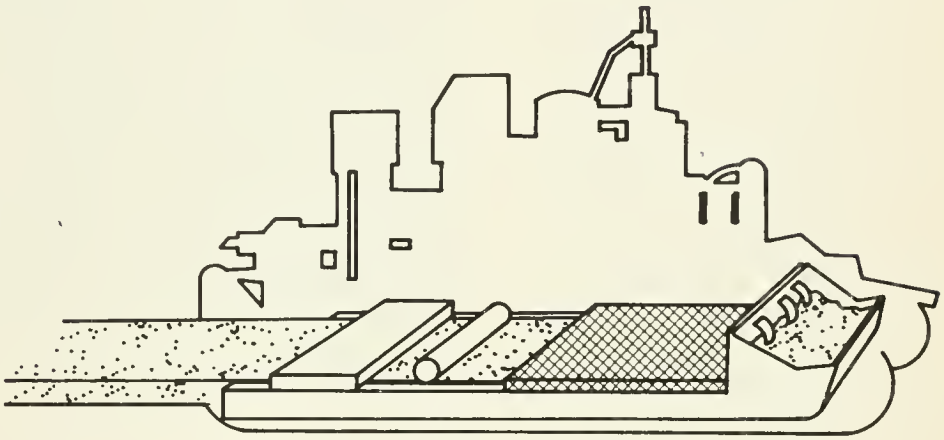


FIGURE 2—Sketch of the conforming screed slipform process.

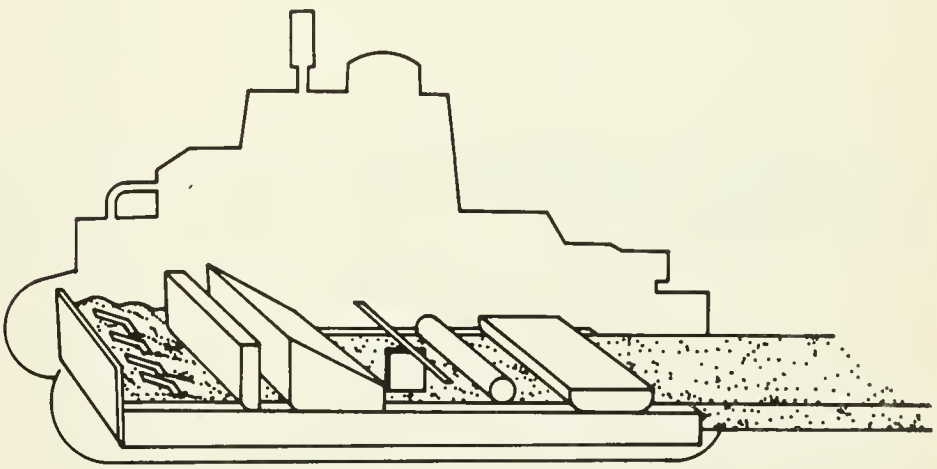


FIGURE 3—Sketch of the pressure meter slipform process.

One of Many

This contractor is but one of many in California now able to exploit the advantages inherent in slipform. Benefit to the highway user, as the ultimate recipient of all cost saving advances,

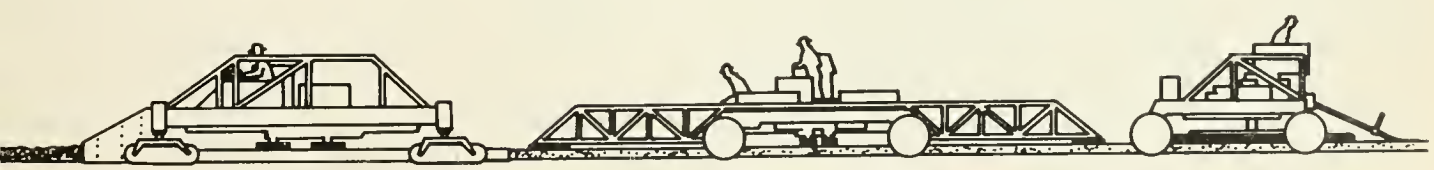


FIGURE 1—Profile sketch of the multiple screed slipform process.

is clearly apparent. It is also discernible in the trend of recent bid prices as illustrated in Table 1.

Lack of restriction on usage of slipform methods regardless of topography, climatic conditions, geometric section or traffic considerations has undoubtedly contributed to this favorable trend.

Several projects which have been slipformed were located in mountainous terrain involving grades up to 6 percent and superelevation up to 12 percent. One of these was paved three lanes at a time.

The other projects which have been slipformed are located in flatter terrain. All of our urban projects are included in this group.

Paving two lanes at a time is the most common practice, largely because 24 feet is the most frequent width of pavement slab required. This paving width is also convenient in placing 48-foot pavements for the increasing number of eight-lane urban freeways being constructed today.

Placing 36-foot pavement, for the substantial mileage of six-lane rural and urban freeways built in recent years, has been accomplished either by first putting down a 24-foot slab followed by a 12-foot slab or by paving the entire 36 feet, three lanes at a time. The amount of pavement constructed by each procedure is split about equally.

SYNOPSIS

After five years of use, slipform paving now accounts for more than 80 percent of all concrete paving in California. It provides significant production advantages to the contractor and benefit of less cost to the highway user, as compared with sideform paving. Three different types of slipform pavers have been successfully employed, but only one is capable of paving three lanes at a time. The procedures utilized when paving three lanes at a time are not significantly different from those utilized when paving narrower widths with the same type of equipment. Successful use of this type of equipment is dependent upon: establishing standard operating procedures through a logical analysis of cause and effect; technically qualified field level supervision; experienced operators and mechanics; properly maintained equipment; uniform concrete at the paver; and, close attention to operational details before, during and after concrete placement.

Different Types of Pavers

Placing pavement in 36-foot paving widths is not a separate subject of itself. In reality, the procedures used to place this width of pavement cannot be said to be significantly different from those used to pave narrower widths when proper allowance is made for certain basic considerations.

Thus, it must be realized that there are several different slipform methods just as there are several different types of slipform pavers. These different pavers are not all presently capable of placing pavements more than 24 feet wide in a single pass. A description, therefore, of construction practices for three-lane at a time paving logically involves discussion of a more general subject: that is, the procedures and techniques utilized with the paver capable of placing three lanes at a time.

Origin of Term

The term "slipform paving" undoubtedly originated because short lengths of sliding sideforms are used instead of the preset sideforms conventionally used. While all methods utilize sliding forms, the term "slipform paving" has come to be generally thought of in a more encompassing sense. We now think of it as applying to the upper surface of the

TABLE 1

BID PRICES AND CALIFORNIA HIGHWAY CONSTRUCTION COST INDICES

	Portland cement concrete pavement		Portland cement concrete structures	Bar reinforcing steel	Asphalt concrete pavement	California Highway Construction Cost Index
	Per cubic yard	Per square yard[1]	Per cubic yard	Per pound	Per ton	
1st quarter 1961	$13.44	$3.15	$53.70	$0.094	$5.92	229.6
2nd quarter 1961	15.35	3.60	52.32	0.093	6.36	252.8
3rd quarter 1961	14.44	3.38	56.35	0.091	5.96	230.5
4th quarter 1961	14.35	3.36	57.97	0.096	5.30	238.5
						Year 239.1
1st quarter 1962	14.87	3.48	57.02	0.092	5.99	235.7
2nd quarter 1962	15.31	3.59	58.65	0.095	6.50	271.1
3rd quarter 1962	15.20	3.56	59.22	0.091	6.71	289.1
4th quarter 1962	14.45	3.39	56.30	0.091	5.68	232.6
						Year 256.2
1st quarter 1963	12.72	2.98	62.87	0.096	6.22	250.4
2nd quarter 1963	12.64	2.96	58.69	0.093	6.47	243.7
3rd quarter 1963	13.14	3.08	57.16	0.082	5.87	249.5
4th quarter 1963	14.49	3.40	59.56	0.091	5.78	243.0
						Year 246.8
1st quarter 1964	14.00	3.28	58.34	0.084	5.61	246.1
2nd quarter 1964	13.09	3.07	58.24	0.088	6.20	248.7

[1] Calculated on the basis of an estimated 1650 cubic yards per lane-mile.

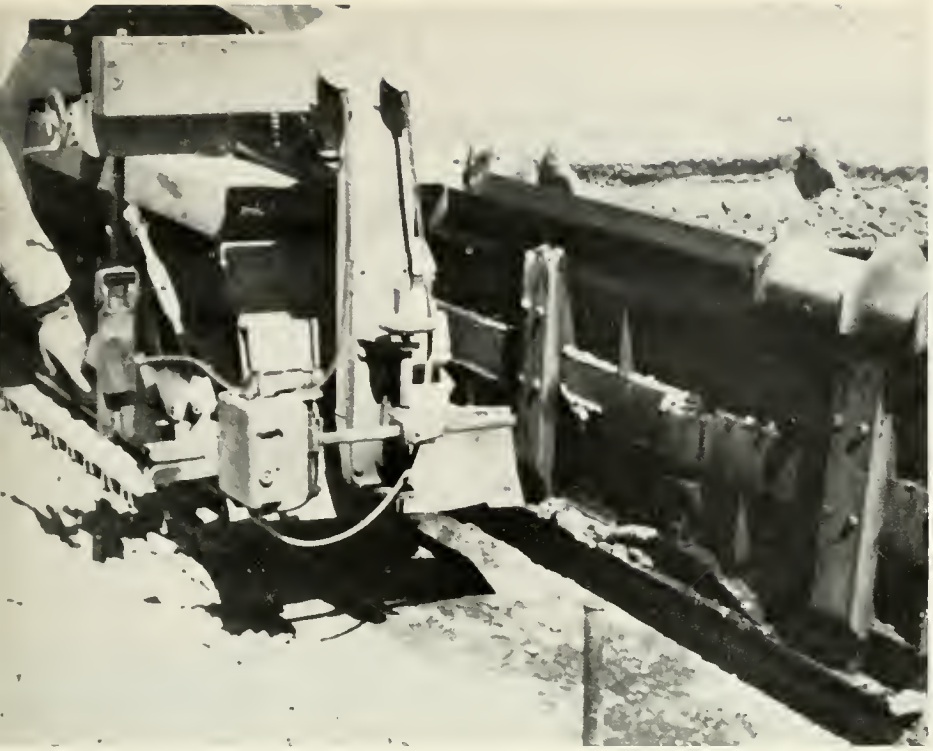


FIGURE 4—A close-up photo of the grade and alignment sensors.

avement as well as to the edges. It is n the latter respect that significant ifferences in method are found.

Three different types of slipform avers have been used in California. ach type is different in operation, nd each involves a different method f paving as we construe the terms.

One type forms the pavement sur- ıce by a repetitive screeding action. Iultiple screeds are used as illustrated n Figure 1, and the operation is sim- ar in many respects to conventional deform paving. This type has not een used in three-lane-at-a-time pav- ng.

Single, Large Screed

A second type of equipment forms he pavement surface by conforming he concrete to desired cross section nd profile under a single, relatively ırge screed as illustrated in Figure 2.

This action has sometimes been re- erred to as "extrusion." For the pur- ose of this article the word "extru- ion" will be avoided. It implies that oncrete is pressed or forced into hape as is metal through a die. In oint of fact, the action is that of lowing concrete into position to com- letely fill a transient form consisting f conforming screed, sliding side- orms and underlying subgrade. The action can be analogized more accurately to the process of permanent mold casting rather than extruding metal.

This second type of slipform equipment is the only one used to date to place pavement three lanes at a time. With it, the paving width can be varied by changing the number of 12-foot-wide modular sections which make up the main chassis.

A third type of equipment has been used only in experimental applications where the paving width was 24 feet. It incorporates an interrelated initial strikeoff screed and a vibrating float pan as illustrated in Figure 3. An excess of material passing under the strikeoff screed causes an upward pressure on the float pan which results in an automatic lowering of the strikeoff screed. Conversely, the strikeoff screed is automatically raised when a deficiency of material occurs under the float pan.

This action is independent of the control derived from the grade wires and, in effect, meters the concrete to a rotating screed located behind the float pan. The rotating screed functions to remove the slight variations resulting because of the finite distance between strikeoff and float pan.

Two Subclasses

In addition to these three type classifications of slipform pavers, two subclassifications can also be identified. They have to do with the presence or absence of automatic controls.

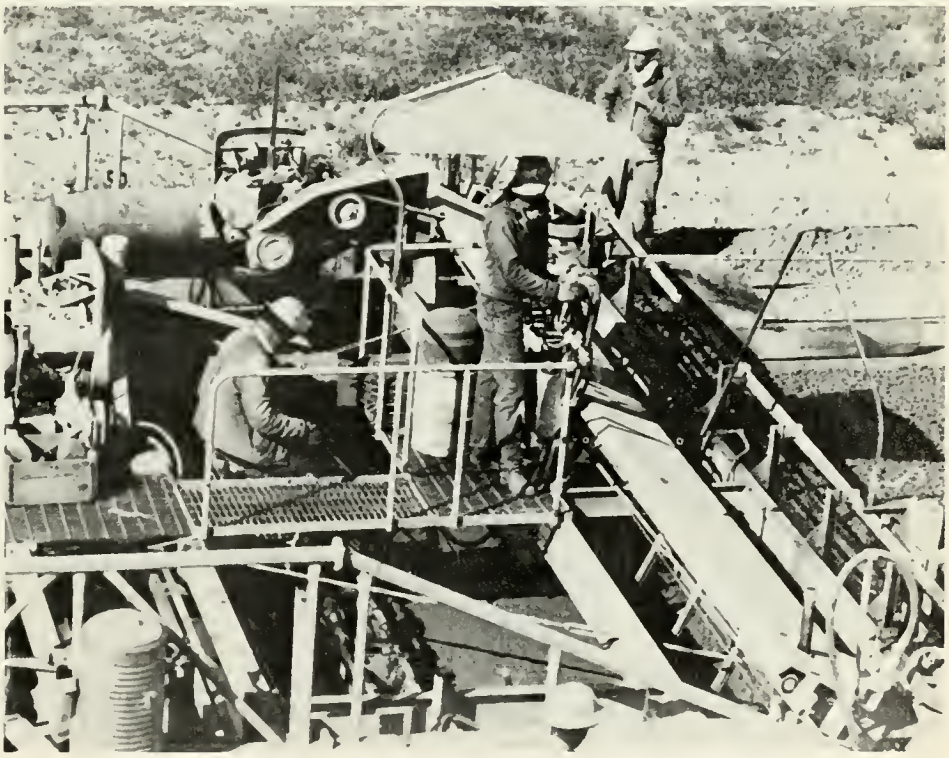


FIGURE 5—Operators (center) can steer manually by use of plumbbob and stringline.

One subclassification includes those pavers which are automatically controlled for line and grade by sensors operating on preset grade wires. The other includes those pavers which are manually steered and have preset screeds.

There are non-automatically controlled pavers of both the multiple screed and conforming screed types. There are automatically controlled pavers of the conforming screed and pressure meter types. We will confine our attention henceforth to automatically controlled machines of the conforming screed type although pavers of the pressure meter type also have potential capability of placing pavement three lanes at a time.

The equipment our interest centers on, then, is that where the pavement profile and cross section is established by flowing concrete into position, by internal vibration, under a relatively large conforming screed automatically maintained at correct alignment and grade.

Key Factors Influencing Results

Success with this equipment is greatly influenced by a number of factors which can be listed as follows:

1—Experienced field level supervision
2—Skilled operators and maintenance personnel
3—Proper care and adjustment of the paver
4—Consistent mix
5—Uniform delivery of concrete
6—Control and integration of all elements of the operation
7—Continuous forward motion of the paver
8—Single set of surveying stakes for subgrade and pavement
9—Accurately set grade wires
10—Well compacted subgrade constructed to tight grade tolerances
11—Proper type and length of sideforms
12—Effective location and frequency of internal vibration
13—Means of compensating for variations in the concrete at the paver
14—Constant surveillance of grade and alignment sensors

FIGURE 6—A photo of the three-lane, 36-foot highway slipform paver in operation.

15—Continuous audit of pavement thickness
16—Conscientious final finishing
17—Progressive analysis of smoothness results

The significance of these factors will become apparent as our discussion proceeds. Their importance is painfully manifest as we look back on our initial efforts.

Analysis of Cause and Effect

In the early period there were few known guidelines and most efforts to improve results were frustrated by aimless, often frantic guesswork.

This chaotic situation was not brought under control until the necessity for an orderly analysis of cause and effect was clearly understood.

The technique adopted then is valid today and it is recommended to all those embarking upon their first slipform experience. It is simply the preparation of a detailed log as the work progresses, listing chronologically all conditions and events which might conceivably affect the completed pavement. Daily analysis of the log for previous work in light of the results obtained will very quickly pinpoint sources of difficulty and indicate proper corrective measures.

California contractors still employ this technique when new equipment models are evaluated or unexpected difficulties are encountered.

The operating procedures evolving from these studies of cause and effect form the basis of our construction practice today.

Ability of Personnel

Any discussion of operating procedures would be sterile without first dealing with the ability required of the men who are to implement them. It should not be surprising that the skill and training of field supervisors, operators and mechanics required to cope with the complex, automated slip form paving equipment is considerably greater than that with conventional sideform equipment. Nevertheless, this fact is not always apprehended, much to the detriment of the results achieved. The so-called "old pro" is rapidly vanishing from the scene. He is being replaced by men with the background of technical training necessary for an understanding of the equipment and the ability to calmly analyze complicated situations and act with logical purpose.

FIGURE 7—The low-profile central mix plant combines portability and high productive capacity.

Maintenance of Equipment

Proper maintenance and adjustment of the paving equipment is also an obvious prerequisite for successful employment of operational procedures. Our experience indicates that the manufacturers are coming to have an increasing responsibility in this area.

The complexity of slipform equipment makes it of paramount importance that skilled technicians only be intrusted with the specialized care required. In practice, this requires occasional factory assistance, which only the manufacturer can provide, plus routine attention by qualified personnel on the contractor's payroll. The most effective arrangement, it seems, is for the manufacturers to maintain factory technicians where they can reach any job in hours, and for the contractors to employ specialized mechanics trained to service the interrelated hydraulic-electrical-mechanical systems involved.

We find that each time the paver is transported from one place to another, whether on or between jobs, it must be thoroughly inspected for misalignment, warping, breakage or inadvertant changes in the setting of various control elements. Adjustment of the screeds must also be checked. The latter is accomplished by driving steel stakes to an offset grade for each corner of the screed and measuring up when the paver is in position over them.

Control of Concrete

Uniform quality of the concrete is another prerequisite to a successful paving operation. It is a matter of general agreement now that uniform quality is absolutely essential in the use of slipform methods, and similar importance is attached to an adequate delivery rate at the paver. Accordingly, a significant change has come about in the proportioning and mixing equipment in current use.

Onsite paving mixers, supplied by batch trucks, have been almost completely replaced. In lieu of these more conventional means, central-mix plants have become very popular and appear destined to be universally adopted.

The new low-profile plants in particular have been well received because of their portability and high productive capacity. Several of these plants in current use are capable of producing 600 cubic yards of concrete per hour. They can be moved from one location to another and set up for full operation in a matter of hours.

One or two of our contractors have taken full advantage of this portability by relocating the plant several times during the course of long paving jobs. A significant advantage of this procedure on a large project is the reduction of hauling units.

While most of the contractors are using stationary tilt-drum mixing units with the low-profile batching plants there are a few who are using the new tilt-drum truck mixers.

New Development

An interesting new development has recently been exploited with respect

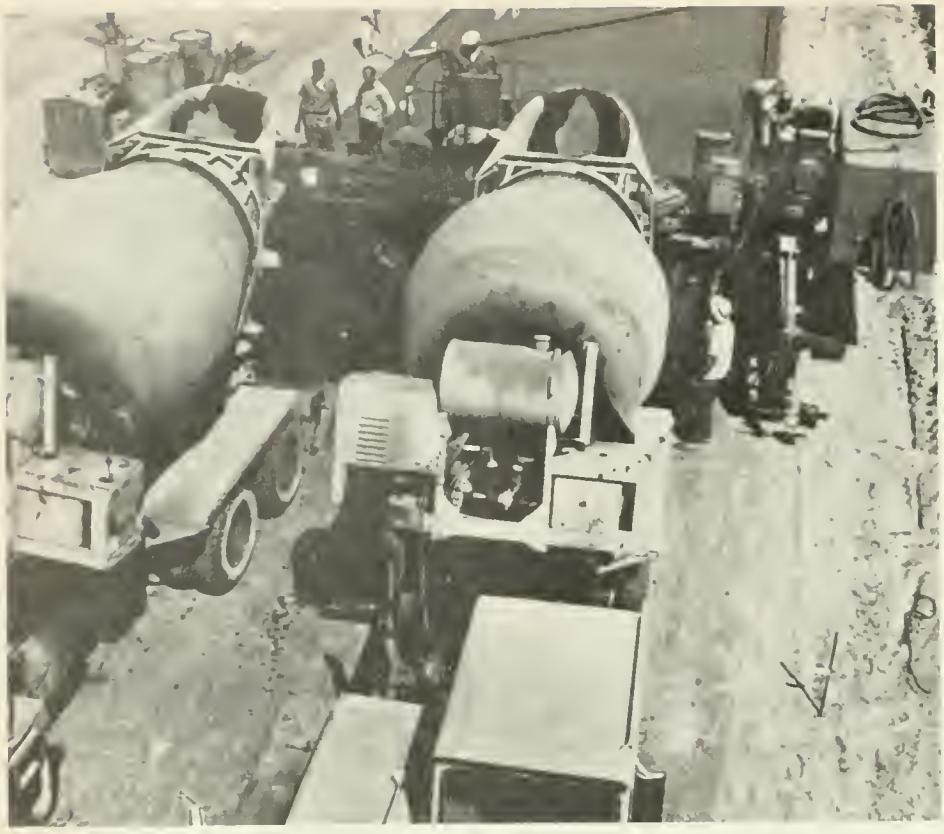


FIGURE 8—A photo of tilt-drum mixers which are being used increasingly with slipform pavers.

to the location of the batching and mixing equipment. The contractor claimed substantial savings were realized in placing his batching plant at the aggregate source and moving his stationary mixer three times during the job. Double bottom-dump trucks were used to haul two eight-cubic-yard batches of proportioned aggregate between plant and mixer. At the mixer a specially built transfer unit off-loaded the trucks onto a covered high-speed conveyor belt which charged the mixer. The transfer unit utilized a hopper with agitating side plates, a self-contained ramp for the trucks, and it was portable. Cement was batched directly into the stream of aggregate as it was charged onto the high-speed belt conveyor.

There is reason to believe that this relatively dust-free technique may be well adapted for use on urban projects. On many of these, smog control rules pose a real problem because of the dust incident to normal batching operations.

Control Facilities

Absorbed as they are with these developments in the type of plant setup, the contractors have not overlooked the importance of control facilities within the plant. We have noticed significant improvement in several important respects. Bins and conveyors have been modified to minimize degradation and segregation. The batching cycle and bin gates have been better coordinated to obtain optimum blending of ingredients prior to mixing. Cement silos have been redesigned to achieve better charging and batching rates. Fully automatic batching and mixing controls have been accepted as indispensible, and their proper use is more effectively policed by the contractors. These and other measures have contributed to a noticeable improvement in the uniformity and quality of the concrete as well as to productive capacity.

Mixing Times

With the increasing attention to all of these aspects of quality control and production capacity it was inevitable that the subject of mixing times also received searching appraisal.

It is common knowledge that for many years California has permitted a minimum of 50 seconds for mixing paving concrete in onsite paving mixers. The performance of our paving concrete and the data from many quality tests all attest to the adequacy of this requirement. With stationary mixers, however, the criterion differed and minimum mixing time was dependent on mixer size.

For an eight-cubic-yard mixer the minimum was 3 minutes and 15 seconds—60 seconds for the first cubic yard plus 15 seconds for each additional cubic yard.

Realizing the serious economic consequences of excessive mixing time requirements, we undertook a series of tests on various sizes and types of mixers. These tests clearly demonstrated the feasibility of modifying our requirements.

We are convinced that the revised requirements resulting from these studies had an important bearing upon the development of slip form paving in California. It was evident that three-lane-at-a-time paving would be prohibitively expensive with the additional mixing equipment necessary to provide sufficient mixing capacity if three minutes plus of mixing were specified.

The basic requirement now is that all concrete must be mixed a sufficient amount of time to produce an adequate mixture, but in no event less than stated minimum periods which are dependent on the type rather than the size of the mixers. These minimums are: 50 seconds for both stationary and onsite paving mixers; 40 revolutions in special truck-type paving mixers; and 70 revolutions in conventional truck mixers.

Adequacy is determined by tests performed on samples of concrete taken from the first and last quarter of sample batches. Differences in slump and distribution of coarse aggregate are noted and the mixing time is adjusted if the data fails to conform to specified tolerances. This is a rare occurrence with modern mixing units in good condition, and minimum permissible mixing times are generally sufficient to produce an adequate mixture.

(Conclusion of this article will appear in the next issue of the magazine.)

High-ranking Distaff Engineer

Checking details on a route planning study still on the drafting board are Senior Highway Engineer Carol Schumaker and Associate Highway Engineers Harold Yamaguchi (center) and William R. Juergens.

Carol Schumaker of La Mirada has just become the highest ranking female engineer in the California Division of Highways.

As a senior highway engineer in the Route Planning Section of District 7 in Los Angeles, Mrs. Schumaker is one of four unit chiefs in charge of highway route planning.

Mrs. Schumaker is a registered civil engineer and a member of the American Society of Civil Engineers. In June 1964, she acquired her master of science degree at the University of Southern California. In addition to her full-time job with Highways, Carol also teaches a night graduate class in geometric highway design at California State College at Long Beach. Her srudents are nine men working toward their master's degrees.

Her recenr promotion to senior highway engineer followed 10 years of service with the division as junior civil engineer, assistant highway engineer, and associate highway engineer. She has been eligible for senior appointment since April 1962, when she was one of two young women and 84 men to pass the civil service examination for this classification. (The division employs 22 women in junior civil, assistant, or associate engineering capacities. Nine of them are in the Los Angeles area.)

In her new position, Mrs. Schumaker supervises three associate engineers engaged in route planning. Route planning begins following the State Legislature's designation of two particular points or termini between which a highway is to be constructed. The Route Planning Section then prepares a project report which covers the engineering investigation and analysis of the specific project, and which discusses the need for and the type of the planned highway improvement and how it should be accomplished, including basic design features. Possible alignments, cost factors of each, community considerations and general feasibility are studied. Close teamwork with city and county planners and engineers is required.

Upon completion of the project reports, a public hearing is held in the area concerned, at which the route planning studies are presenred. All of the alternate routing studies are explained in terms of relative advantages and disadvantages, with the assistance of maps and aerial photographs. Many individual questions are answered by the route planning engineers at the hearing and at map displays which precede it.

With all the information assembled, including public reaction, the project is ready for the State Highway Engineer's final review and his recommendation to the Highway Commission. Adopring a route, after notification of local authorities and perhaps another hearing, is done by the Highway Commission.

A typical example of major freeway routings with which Mrs. Schumaker will he immediarely concerned is a 26-mile section of the proposed Route 64, starting at State Sign Route 1 about 10 miles west of Santa Monica, running north through mountainous terrain and swinging east through San Fernando Valley to connect with US 99-Interstate 5.

Another routing of particular interest because of its designation as a scenic highway is the proposed improvement of a 10-mile section of State Sign Route 150 in the Ojai Valley in southwestern Ventura Counry.

Mrs. Schumaker's new job brings her well over a thousand dollars a month. The top figure for a senior highway engineer is $1,166. This compares with a range of $829 to $1008 in her previous job as associate highway engineer.

As an associate, Mrs. Schumaker worked in Design, which is the next

Mrs. Schumaker holds a master of science degree from the University of Southern California. In addition to her responsible position with the Division of Highways, she teaches an evening graduate class in Geometric Highway Design at California State College in Long Beach. Her nine male students are working toward their master's degrees.

step after the Highway Commission has adopted a route. At this stage, geometric and structural design of the roadbed are completed, contract plans are reviewed, and research and special studies are carried on. Also, drainage and other cooperative agreements are drawn up, and erosion control and roadside development are worked out.

Her biggest project while in Design was the San Diego–San Gabriel River–Garden Grove Freeway Interchange, under construction in Orange County, near the Los Angeles county line. Although only two levels, it has many complicated connections. A portion of this interchange is scheduled for opening in the early summer of 1965. She also worked on the interchange of the San Diego and Long Beach Freeways, which has been in use for about a year.

Mrs. Schumaker's desire to become an engineer had already formed in high school. She particularly liked math, physics and science courses. This was in Kingsford, Michigan, near Hancock —her birthplace in 1929. She attended Purdue University, graduating in 1952 with a B.S.C.E. degree. About halfway through her senior year Carol Rogge married Bernard Schumaker, also a Purdue graduate and an engineer.

In 1954 they came west, and she began her career with the California Division of Highways. Her husband pursued structural engineering, working for the Building and Safety Department of the City of Los Angeles, and also with consulting engineering firms in the area. Several years ago he left engineering to enter teaching, and presently is a science instructor at the Sunny Hills High School in the Fullerton Union High School District in Orange County. The Schumakers have a son, Paul, II.

Charles Ford, in charge of freeway route planning in the Los Angeles District says, "I have followed Mrs. Schumaker's career for some time and I particularly admire the fine work she has done in the design of major interstate freeways. In what is largely a man's world, she has the professional, yet definitely feminine touch. She is now entering the very important early planning phase of this work and I am sure her talents will continue to serve us well."

On a previous assignment for the Design Section, Mrs. Schumaker checked blueprints of an interchange with Resident Engineer John H. Muhich (right), and William T. Robinson, a highway engineering associate. The resulting two-level structure, designed under her supervision, will connect the San Diego, San Gabriel River, and Garden Grove Freeways in Orange County. A portion of this interchange is scheduled to open this summer.

For the present, Mrs. Schumaker has not set her sights on any further pinnacles of achievement. "It's challenge enough to come up with the full information needed for the Highway Commission to select the most advantageous route for all concerned," she says, "and I'm primarily concerned with doing justice to the job at hand.

"California's Division of Highways offers real professional opportunity to women, not only in engineering, but in other high-level jobs as well. It's gratifying to know that 'the door is open.'"

Mrs. Schumaker reviews a route-planning study with the three associate highway engineers under her supervision. Clockwise around her desk are William R. Juergens, Robert E. Tomlinson, and Harold Yamaguchi (back to camera).

George M. Webb Wins Top National Award

Nationwide recognition for his accomplishments in traffic engineering was given to George M. Webb by the Institute of Traffic Engineers at its 1964 annual meeting in Miami Beach, Florida.

Webb, who retired in 1963 after nearly 10 years as traffic engineer for the California Division of Highways, was announced as the recipient of the Theodore M. Matson memorial award "for outstanding contributions to the advancement of traffic engineering."

He is the eighth person to receive the award, and the first from the western United States. It is considered the top award nationwide in the traffic engineering profession.

GEORGE M. WEBB

Webb was present to accept the award and accompanying plaque. He also presented a paper on "The Organization and Administration of a State Highway Traffic Department."

The formal presentation was made on behalf of the I.T.E. by Charles W. Prisk, deputy director of highway safety for the U.S. Bureau of Public Roads and a previous Matson award winner. Prisk praised Webb's leadership in traffic engineering and traffic safety research not only in California but nationwide, through his service on numerous special study committees.

Prisk called Webb "a traffic engineer's traffic engineer."

Webb, whose home is in Sacramento (1825 Caramay Way), retired from state service in May 1963, after a highway engineering career that began in 1919 in his native Oregon and was interrupted only by service in the Army Transportation Corps in World War II.

From 1919 to 1928, Webb worked for the Oregon Highway Department on location, construction and maintenance in the central part of the state, around Bend. Moving to California, he was assigned to the location crew for the Feather River Highway, and then worked in the Redding and Eureka districts and in the Bridge Department. He transferred to Division Headquarters in Sacramento in 1942, and subsequently devoted almost all his engineering activities to the traffic field. He was appointed division traffic engineer in 1953.

For each year of Webb's service as traffic engineer, California won or tied for first place in traffic engineering achievement in the nationwide inventory of traffic safety activities sponsored by the National Safety Council.

He also achieved national prominence through his authorship or co-authorship of numerous widely published reports and articles on traffic engineering, and his service on committees of the Highway Research Board, the American Society of Civil Engineers and the American Association of State Highway Officials.

DIVISION WILL INCREASE USE OF MEDIAN BARRIERS

Close examination of the results achieved by median barriers in preventing spectacular and usually fatal head-on crashes between vehicles traveling on freeways has resulted in a decision by the California Division of Highways to increase their use.

The barriers, which block drivers from crossing medians and entering lanes bearing opposing traffic, are now installed on approximately 250 miles of the state's 1,500 miles of freeways.

A series of dynamic tests, in which remote-controlled automobiles carrying anthropometric dummies were purposely driven at high speed into barriers of various construction, were conducted by the Division of Highways beginning in 1958. Examinations of the crash effects on the vehicle, the dummy and the barrier materials themselves led to the use of particular barriers under specific conditions.

They normally consist of heavy steel cables or metal beams, but in areas where pedestrians might be tempted to cross a freeway, the cables are augmented with chain link fencing. Other types are used where drifting snows present a particular problem.

Highway engineers and other traffic experts entertain mixed opinions regarding the dividers, for although fewer accidental deaths and critical injuries occur where they are emplaced, the overall accident rate generally rises.

This is because most drivers who do momentarily lose control and veer into opposing traffic lanes are able to recover in time to avoid accidents.

But according to James E. Wilson, Division of Highways traffic engineer, a vehicle traveling at high speed obviously cannot careen into a median barrier without suffering substantial damage.

"We are trading property damage for lives," says Wilson. "The barriers must be strong enough to stop or turn a car and head it back into its own traffic flow where the odds are good that the driver can either stop or regain control without hitting another vehicle."

Wilson notes that persons are sometimes killed and injured in accidents involving median barriers but he points out the frequency is far below the rate experienced in head-on collisions.

In the past, barriers were not used in medians over 36 feet wide unless special hazards existed or an abnormal number of wrong-way accidents occurred in a specific area. Now medians up to 46 feet in width are eligible for barriers.

During the 1958 studies, it was discovered that two-thirds of the head-on crashes could be eliminated if median barriers were erected on freeways where daily average traffic exceeded 60,000 vehicles. After the dividers were installed in keeping with this criterion, fatal accidents from this type of mishap dropped from 45 in 1959 to an average of 20 a year, despite a doubling in freeway traffic.

DIVISION BEGINS INSTALLATION OF WRONG-WAY SIGNS

Statewide installation of two new signs will take place during the next few months as another step in the continuing program of the California Division of Highways to discourage drivers from entering freeways in the wrong direction.

Red-background signs bearing the message WRONG WAY will be placed on each side of all off-ramps, near the exit points. The letters will be white on the red background and both colors will be highly reflective. The signs will not be visible to drivers proceeding in the proper direction.

On-ramps will be identified by signs that read FREEWAY ENTRANCE. This reassuring message will also be in white letters, but on the standard green background which motorists associate with normal state highway directional signs.

The red and green backgrounds were purposely selected because of the respective "stop" and "go" situations most people identify with them.

Although the new signs have been officially approved for installation, it will take several months before the signs can be procured and installed at all the approximately 5,000 ramps included in the freeway system, according to State Highway Engineer J. C. Womack.

In some off-ramp locations, two experimental devices will be tested in conjunction with the new signs.

The first is a reflective pavement arrow visible only at night. It consists of a series of inconspicuous plastic wedges that pick up the beams of automobile headlights aimed in the wrong direction and transforms them into a red arrow pointed at the oncoming vehicle.

The second is an auxiliary white and red sign that reads GO BACK —YOU ARE GOING WRONG WAY. Single installations will be made on the right side at the approximate midway point of all off-ramps in the San Francisco Bay area. They will be visible only to wrong-way traffic.

Womack expressed the hope that the new devices will prove effective in curbing at least some of the 8 percent of freeway fatal accidents now caused by wrong-way movements. These accidents result in 30 to 35 deaths each year. He pointed out that the fatalities include not only offenders but many innocent persons who were proceeding in the right direction.

Womack cited a recent study by the Division of Highways which indicates that approximately 50 percent of the wrong-way drivers enter freeways at off-ramps.

The study also revealed that approximately one-third of the offenders had been drinking—and more important—that drinking drivers were the offenders in 85 percent of wrong-way fatal accidents.

Womack hoped the signs will have a positive effect on even drinking drivers, but observed that they are "an extremely difficult group to reach with a safety message."

All the devices have enjoyed a high degree of success at an Interstate 80 on-and-off ramp northeast of Sacramento where they have been installed for several weeks, according to traffic engineers.

Change in Bid Form Will Reduce Error

The State Division of Highways has revised the proposal form for submission by bidders on highway projects.

Beginning with all projects advertised for bids on or after November 16, "figures only" will be used by bidders to specify prices of items. The old form calling for both words and figures has been discontinued.

This change is designed to reduce the possibility of error in proposals submitted.

The first bid opening incorporating the change to "figures only" took place January 6 in Sacramento.

Highway Site Yields Oldest Artifact Yet

A lump of cooking charcoal recently discovered in the buried remains of an ancient Indian village in eastern Mendocino County has proven to be nearly 1,000 years older than any previously recorded history of man in northern California, State Archeologist Francis A. Riddell has reported, according to a recent report by the State Department of Parks and Recreation.

Riddell said radiocarbon tests just completed by Geochron Laboratories, Inc., of Cambridge, Massachusetts, have established the charcoal's age at 5,320 years. The earliest previously recorded traces of man in northern California were from an Indian village site near Alamo, in Contra Costa County, and were 4,400 years old.

The historic charcoal find was made by James Dotta of Redding, president of the Northern California Archeological Society, working under contract with the State Division of Beaches and Parks. It was unearthed on the Porter Chaffee ranch on Cold Creek, at the junction of State Highway 20 and Potter Valley Road, between Ukiah and Upper Lake.

Dotta has been working at four Cold Creek area sites that will soon be destroyed by highway construction. The Division of Highways is paying for an archeological search of the sites and the removal of their significant artifacts.

To date the charcoal discovery site on Cold Creek has yielded 620 artifacts. They include dart points of flintlike chert, obsidian knife blades, a variety of crude stone tools, stone mortars and pestles, and a number of *manos* and fragments of stone *metates* used in grinding flour from grass seeds.

The January 1965 edition of the *California Historian*, publication of the Conference of California Historical Societies, contains a message from Governor Edmund G. Brown mentioning the Mendocino find and adding:

"The state is doing this work because California cannot afford to lose its history."

Henry McCarty Ends Long State Career

Henry C. McCarty, office engineer in the Division of Highways Sacramento Headquarters since 1947, retired in November.

McCarty has had the key responsibility of advancing budgeted highway projects to the construction contract stage as soon as the planning and right-of-way acquisition have been completed by other units of the division. He has also had the responsibility of processing payments to highway contractors as work progressed and has supervised the preparation and submission of agreements and supporting documents under which California has collected the federal aid highway funds apportioned to this state.

HENRY C. McCARTY

The advancement of projects to contract stage includes correlation of plans, specifications and estimates prior to advertising for bids, advertising for bids, issuance of proposal forms to prospective bidders meeting prequalification requirements, opening the bids, preparing contract award recommendations and preparing and processing contract documents after award. Some 500 major highway projects with a total construction value of more than $350,000,000 per year are placed under contract through McCarty's office.

A registered civil engineer, McCarty is a native of Kansas, where he received his primary schooling. He moved to San Diego in 1917, attending high school and San Diego State College and later the University of California at Berkeley, where he received his degree in 1925.

His first six years of employment after graduation were with the city engineer's office in San Diego.

He entered state service in 1931 as a draftsman-computer in the division's Sacramento Headquarters and transferred to the District 6 office in Fresno in 1935, where he worked in construction and maintenance. McCarty returned to Sacramento Headquarters in 1940 to work in the planning and design functions. In 1943 he was appointed assistant office engineer, and in 1947 to his present position.

His avocations include electronics.

He and his wife, Ada, live at 1448 Arvilla Drive, Sacramento.

Bridge Department's E. L. Walsh Retires

Everett L. Walsh, bridge office engineer for the California Division of Highways, has retired after 37 years in state service.

Walsh has been responsible for administering all service units of the Bridge Department including accounting and personnel and the negotiating of maintenance and construction agreements with railroads concerning grade crossings and seperations.

EVERETT L. WALSH

A native of Minnesota, Walsh attended grade and high school at Tacoma, Washington, and studied engineering at the University of Washington in Seattle.

From 1917 to 1924 he worked as surveyor and inspector for the Northern Pacific Railroad and the Weyerhaeuser Timber Company.

He joined the Washington State Division of Highways as assistant resident engineer in 1924 and came to work for the California Division of Highways in 1928.

He served as field engineer in charge of preliminary investigations and borings on the construction of the San Francisco–Oakland Bay Bridge and was promoted to supervising bridge engineer in 1947.

Walsh is a member of the American Society of Civil Engineers and is past president of the Sacramento section. He is also a member of Delta Upsilon and the University Club of Sacramento.

Walsh and his wife, Mary, will take up residence in their new home at Little River on the Mendocino County coast.

IN MEMORIAM

District 1

John H. Kennedy, assistant highway engineer.

District 3

Alvin E. Smith, highway maintenance man III.

District 4

Gerald D. Davis, junior civil engineer.

District 5

Virgil D. Martin, highway maintenance man III.

Frank S. Sackrider, assistant highway engineer.

District 7

Kathryn L. Anthony, delineator.

Byron V. Hauger, associate right-of-way agent.

John P. O'Hara, assistant highway engineer.

Robert C. Van Marter, engineer aid II.

District 9

Robert E. Miller, highway maintenance man III.

District 11

Mike R. Ramirez, highway maintenance man III.

Headquarters

Ray D. Lenau, highway engineer associate.

Shop 7

Einar W. Carlson, heavy equipment mechanic.

Paul C. Sheridan Is Office Engineer

Appointment of Paul C. Sheridan of Marysville as office engineer for the California Division of Highways was announced by State Highway Engineer J. C. Womack.

Sheridan, who was promoted from assistant district engineer of District 3, which includes 11 Sacramento Valley and mountain counties, assumed his duties in Headquarters office in Sacramento on November 18. He succeeds Henry C. McCarty, who recently retired.

PAUL C. SHERIDAN

In his new position, Sheridan will be responsible for a wide range of activities involving the advancement of budgeted highway projects to the construction stage as soon as planning and right-of-way acquisition have been completed. Other administrative engineering functions of the office engineer include processing payments to contractors and the supervision of the preparation of federal aid documents.

A native of Oakland, Sheridan was raised there and in San Rafael, and attended Marin Junior College and the University of California. He joined the Division of Highways in 1931, the year following his graduation with a degree in civil engineering.

Virtually all his highway career, beginning as a construction inspector in the Lake Tahoe area, has been in District 3.

Sheridan was promoted to assistant district engineer in 1950.

Sheridan is a past president of the Marysville Branch, Sacramento Section, American Society of Civil Engineers. He is a member of the Commonwealth Club of San Francisco and of E Clampus Vitus. He has also been active in Parent-Teacher Association and Boy Scout work in the Marysville area.

He and his wife Eleanor have four children and one grandchild.

Bartlett Twins of District 2 Retire

Wallis H. (Pat) and Willis H. (Bart) Bartlett, twin employees with the Division of Highways, recently retired in Redding.

Pat and Bart were born in Redding and attended high school in Klamath Falls, Oregon. Bart also attended Oregon State College, where he received his B.S. degree in civil engineering.

WALLIS H. (left) and WILLIS H. BARTLETT

The Bartlett twins worked on the initial surveys and construction of Route 70 in the rugged Feather River Canyon between Oroville and Quincy.

Pat, who retired as a highway engineering technician I, completed his entire state service in District 2. His initial appointment dates back to September 30, 1921. He left the state service in April 1923 for private employment and returned in May 1927. He served in the U.S. Army during World War II. The major portion of his highway service has been on construction work. Pat and wife Wilda plan to continue their residence in the Redding area.

Bart, one of the earliest to join the District 2 organization, signed up as an axman and chainman on June 11, 1919. He worked intermittently while attending school until he graduated from college and returned on a permanent basis in May 1927. He was temporarily transferred to District 6 in 1937 and to District 5 in 1941. Bart has served on location surveys, design, and construction. He retired as an associate highway engineer.

Bart and wife Hazel plan to continue residence in the Redding area.

John Kozak Joins Bay Toll Crossings

Appointment of John J. Kozak of Sacramento as principal bridge engineer with the State Division of Bay Toll Crossings in San Francisco has been announced by Chief Engineer E. R. Foley.

Kozak has been supervising bridge engineer in charge of special studies for the State Division of Highways headquarters office in Sacramento since 1961.

In his new position, Kozak will serve as assistant to Foley in the general administration of the Division of Bay Toll Crossings which was established by the Legislature as a separate division of the State Department of Public Works last year.

JOHN J. KOZAK

His appointment was effective November 1.

A native of Rhode Island, Kozak holds a bachelor of science degree from the University of Rhode Island and a master of science degree from Yale University. He served with the U.S. Corps of Engineers from 1942 to 1946 and was awarded a bronze star medal.

Kozak came to work for the California Division of Highways in 1947.

From 1947 to 1949 he was resident engineer on several bridge construction projects in the San Francisco Bay area, after which he joined the bridge design section in Sacramento.

He was promoted to senior bridge engineer in 1953 and was put in charge of adapting electronic computer methods for use by the Bridge Design Section in 1956.

Kozak is a member of the American Society of Civil Engineers and the Toastmasters Club of Sacramento.

He and his wife, Margaret, who reside at 2024 Santa Lucia way in Carmichael, have five children.

Highways List of Recent Retirements

District 1

Sydney W. Anderson, assistant highway engineer, 36 years; George A. Bradburn, highway maintenance man II, 36 years; Carlton H. Clark, highway maintenance man II, 18 years; Benjamin J. Dashiell, highway foreman, 44 years.

District 2

Wallis H. Bartlett, highway engineering technician I.

Willis H. Bartlett, associate highway engineer, 38 years; Adolph L. Jacobson, highway maintenance man I, 8 years; Jack Swank, highway maintenance man III, 23 years.

District 3

Sam L. Ferguson, highway landscape leadingman, 11 years.

District 4

Noble T. Haakensen, assistant highway engineer, 11 years; Herbert A. Hart, associate highway engineer, 32 years; John P. Dietrich, assistant highway engineer, 13 years; George F. Oliveira, groundsman, 17 years; Fred W. Walker, highway engineering technician I, 11 years.

District 5

Herman J. Bender, assistant highway engineer, 35 years; John A. McAnallan, highway field office assistant, 17 years; James C. Meehan, highway maintenance man II, 33 years.

District 6

Tracy O. Cunningham, highway foreman, 36 years.

District 7

David T. Coull, highway landscape maintenance man, 10 years; Carl R. Hagberg, highway engineering technician I, 30 years; Larry P. Madrid, highway maintenance man II, 21 years; Harry Royal, highway maintenance man II, 31 years.

District 8

Clarence V. Blackburn, highway maintenance man III, 33 years; Clark L. Hopkins, highway maintenance man II, 25 years; John L. LeBarge, senior highway foreman, 37 years.

District 9

George M. Bennett, building maintenance man, 10 years.

District 10

Herbert M. Parker, senior highway foreman, 33 years.

District 11

George A. Gray, associate right-of-way agent, 34 years; Emil B. Johnson, senior delineator, 31 years; Roy Still, highway maintenance man II, 28 years; Elmer F. Wolin, highway maintenance man II, 13 years.

Headquarters

Harry D. Bowers, supervising landscape architect, 36 years; George J. Grohman, associate highway engineer, 35 years; Walter Landers, senior highway engineer, 36 years.

Bridge

Aldrich D. Dykstra, associate bridge engineer, 34 years; John K. Neff, assistant bridge engineer, 31 years; Charles R. Poppe, supervising bridge engineer, 37 years; Albert J. Stocks, associate bridge engineer, 38 years.

Twenty-five-year Awards Announced

The following Division of Highways employees have received their twenty-five-year awards since the last list was published in the May–June 1964 issue of the magazine.

James E. Bennett, Robert W. Bower, Charles B. Bye, Lelia R. Conwell, Mary E. Darling, Dorothy F. Dixon, Bernal E. Gold, A. J. Grewe, Calvin J. Jackson, Donald H. Johns, Robert T. Martin, Ernest Lee Mastus, Dewey C. Miller, A. L. Muller, Wm. J. Metz, J. C. Obermuller, James N. Olivieri, Paul G. Ostrom, Prescott R. Reed, J. R. Rouppe, Sterling S. Searcy, Alvin E. Smith, Jos. E. Turnham, Claude L. Williams, Vernon B. White, Fred H. Yoshino, Robert D. Zaniboni, Wayne LeFevre.

Right of Way Loses George J. Grohman

George J. Grohman, associate highway engineer with the California Division of Highways, has retired after 34 years with the state.

Grohman is a recognized expert in right-of-way engineering, a field that has come into special importance as a result of the accelerated highway and freeway construction throughout the state and nation.

Grohman, who was born in Tampa, Florida, attended grade and high school in Stockton, California, and graduated from the University of California at Berkeley with a degree in civil engineering.

Following graduation he worked for several years doing drafting and surveying for private utility and title companies.

From 1929 to 1931 he worked for the State Department of Water Resources as part of the staff of a groundwater investigation in San Joaquin County.

Grohman came to work for the State Division of Highways in May of 1931. He transferred to the District 6 (Fresno) office in 1936 and returned to the Sacramento office six months later.

He is a member of the American Society of Civil Engineers and the American Right of Way Association. He has been active for many years in church affairs in Sacramento.

Grohman and his wife, Myrtle, live at 1732 Vallejo Way in Sacramento. They have a son and two daughters and seven grandchildren.

Materials and Research

Jessie E. Early, engineering aid II, 27 years; Ralph H. Kipp, associate steel inspector, 39 years.

Shops—Headquarters

Phyllis J. Smith, accounting technician II, 36 years.

Shop 7

Harold L. Ryan, automobile mechanic, 16 years.

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Advance Plans Chief For Bridges Retires

Charles R. Poppe, advance planning engineer for the Bridge Department of the State Division of Highways, has retired after 37 years in state service.

Poppe's job included responsibility for all bridge site investigations, preliminary design reports, review of project reports and collecting and correlating data for bridge design. The Bridge Department initiates design on more than 500 structures annually.

CHARLES R. POPPE

A native Sacramentan, Poppe attended local schools here and obtained his B.S. degree in engineering from the University of Nevada. He joined the California Bridge Department in 1927 as an assistant resident engineer. He became a resident engineer in 1930 and supervised construction on many bridges throughout the state. He went into bridge design in 1942 and became chief designer in 1946. He was appointed federal aid secondary engineer for bridges in 1948 and was promoted to advance planning engineer in 1950.

Poppe is a member of the American Society of Civil Engineers, the Masonic Lodge and the Shrine.

Poppe, and his wife, Eloise, have two sons.

SIGN ROUTE 4 JOB

The State Division of Highways has opened bids on a project in Contra Costa County for grading and paving and structures on 4.7 miles of four-lane freeway on Sign Route 4 between two-tenths mile west of Cummings Skyway and one-tenth mile west of Howe Road in Martinez. Included in the project is construction of the Cummings Skyway Overcrossing; the McEwen Road, Alhambra Avenue and Alhambra Way Undercrossings; and the Muir Spur Overhead for the Atchison, Topeka & Santa Fe Railway.

Tempus Fugit Column

January 1940—Tehachapi Pass Unit Opened

A 4.6-mile section of State Highway 58 has just been completed between Bear Mountain Ranch and one mile north of Keene, as part of the reconstruction of the important Tehachapi Pass route, eliminating many steep grades and sharp curves. During the past five years, weekday traffic has increased 148 percent. During the wildflower season, daily traffic flow reaches nearly 4,000 vehicles. Another 4.3-mile segment to the east of the newly opened section is now under construction.

The original road through the pass was a wagon trail built during the mining excitement caused by the discovery in 1870 of silver in the Panamint Valley just west of Death Valley.

February 1940—Cost of Snow Removal

Each winter approximately 3,400 of state highways which traverse the high mountain areas are cleared of snow so that normal communication and travel will be possible. The magnitude of the task is apparent from the size of the annual bill, which has varied from $390,000 during a mild winter, to as much as $575,000 during a severe winter.

January 1940—Newhall Tunnel Replaced by Cut

Across the northerly end of the San Fernando Valley, the rugged Santa Susana Mountains have long represented a troublesome barrier to road building. Until 1910, a narrow vertical cut known as Fremont Pass served travelers to the north of Los Angeles. For the next 20 years an arch tunnel, 17½ feet wide, served the rapidly increasing traffic. In 1928–29 Division of Highways constructed a three-lane highway through Weldon Canyon, west of the tunnel, for traffic to the San Joaquin and Sacramento Valleys, thus relieving the seriously bottlenecked tunnel of a large portion of traffic. But with the huge increase in traffic from 1930–40, Newhall Tunnel again became an intolerable bottleneck.

In 1938, a contract for reconstruction of this portion of the route as a unit new alignment between the San Fernando Valley and Mojave along the so-called Mint Canyon Shortcut. Major interest centered around replacement of the 435-foot tunnel with an open cut. Traffic was carried through the tunnel during construction, and the project finally emerged as a modern four-lane highway with raised central dividing strip.

Approximately 857,000 cubic yards of earth were removed. Cost for excavation was approximately $191,000; total cost of the project being $475,700.

January 1940—Old Indian Trail Over Mauntain Springs Grade Being Modernized

The old Mountain Springs Grade connecting San Diego and Imperial Counties, which supplanted ancient Indian trails, is in turn to be replaced by a standard highway over the Inko-pah Mountain Range, with complete realignment of Route 12 (now a part of Interstate 8) between Boulder Park and Coyote Wells, reports E. E. Sorenson, District 11 construction engineer.

The average passenger car, which negotiated the old grade at 20 miles per hour, can now travel the new route at the legal speed limit. Sight distance, which hampered travel on the old route, has been increased to eliminate all interference. Construction involved about 270,000 yards of rock excavation.

Past records indicate that the Mountain Springs route between the Imperial Valley and the coast proved difficult, but nevertheless the only feasible one for the primitive Indians, as well as the motorist of today.

SISKIYOU COUNTY CONTRACT

The State Department of Public Works has announced the award of a $1,456,000 contract in Siskiyou County to Peter Kiewit Sons' Company, Medford, Oregon, for converting the existing two-lane US 99 to four-lane divided Interstate 5 Freeway between the Oregon state line and 1.5 miles south.

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12,000 SHRUBS AND TREES AND HOW THEY GREW

Roadside slopes on US 99 through Tulare were barren before an ambitious landscaping program by the Division of Highways was begun, but a 3½-mile project from Paige Road to Prosperity Avenue brought results almost sooner than one could expect. Armed with 1,019 firethorns and 9,712 oleanders (shrubs) and 655 trees of several kinds, the planters had wrought such a difference in the appearance of the freeway in one year's time that Editor Tom Hennion of the Tulare *Advance Register* was prompted to describe it in editorial and pictorial form last summer. Since then, we have been waiting for the wintertime show of color (which resulted in this issue's back cover). Their editorial is reprinted below, as are the before and after pictures which originally appeared in the *Advance Register*.

A REAL PLANTING JOB

There was a time when we were riding the Division of Highways pretty hard to get them to landscape the freeway through the east part of the city. It seemed like the "Gulch" would forever remain an unsightly, dusty trench through the city.

Eventually, however, they got around to do a job of landscaping.

And believe us, they knew what they were doing, once they started.

The area around the Tulare Street overpass today is well on its way to being one of the heaviest landscaped intersections to be found anywhere. We can't recall a single spot anywhere between Los Angeles and Sacramento that is as well planted, as green or as attractively laid out as that one.

Just take a drive along the freeway, including the off-ramps and the on-ramps, and you'll see what we mean.

And take a careful look at the pyracantha plantings. Come next Christmas time we're going to have a spectacular show of color.

Thanks for a job well done.

California Highways and Public Works
DIVISION OF HIGHWAYS
P O Box 1499
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Squaw Creek

At upper left is shown a view of the canyon that Squaw Creek, in Mendocino County, near Cummings, cut across the Redwood Highway during the Christmas storms. Photo was made December 27, 1964, before any reconstruction was yet organized. Photo above shows gulf from other side on January 16, partly filled. Below is a picture of the highway on March 17, 1965, carrying normal traffic. About 25,000 truckloads of fill were required to bring the road back up to grade. (See article beginning on page 14.)

California Highways and Public Works

FEB IN STACI

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Editors are invited to use information contained herein and to request prints of any black and white photographs.

Address communications to: EDITOR,
CALIFORNIA HIGHWAYS AND PUBLIC WORKS
P.O. Box 1499
SACRAMENTO, CALIFORNIA 95807

FRONT COVER: View of the Golden State Freeway (Interstate 5) in Los Angeles, showing development of landscaping in six years. Planting was made late in 1958, photograph was made late in 1964. Palms in foreground framing view are Mexican fan palms, Washingtonia robusta, closely related to the California fan palm, but more vigorous and adaptable. Ground cover is Algerian ivy. Trees were 3–4 feet high when planted. Overcrossing is at Los Feliz Boulevard. Photo by Sam Smith, District 7, Los Angeles.

BACK COVER: Photo made exactly two months after disastrous Christmas week floods in northern California shows Bailey bridge in place across washed-out span on Smith River, US Highway 199, between Crescent City and the Oregon line. Torrents tore out several miles of this highway, in addition to three major bridges. Since major traffic load in winter is industrial, reconstruction had to support full legal loads, which road is now carrying. See articles on reconstruction in this issue. Photo by Robert Mulno.

Opening a Lifeline

Temporary Bridges, Mud, Machines and Hard Work

By JOHN ROBINSON, Information Officer

In the aftermath of the Christmas 1964 floods, came an associated economic problem for the areas isolated by the destruction of the transport system. It was a simple chain reaction. If the industry of the affected counties, 75 percent timber products, could not get its production to market, production must cease as soon as all storage facilities were filled. Within two weeks, this was costing the area about $75,000 a day.

The areas of worst damage were in the State Division of Highways District 1, and western portions of District 2. This included Del Norte, Humboldt, Mendocino, Trinity, Siskiyou, and portions of Shasta and Tehama Counties, all of which had isolated sections, some hopelessly cut off from outside help.

Although there were emergencies everywhere, it was obvious that a major object of highway workers must be the earliest possible reopening of a highway "lifeline" into and out of the isolated region.

In the initial phase of reconstruction of transport, the same factors that hampered other agencies hampered the highway employees. With the breakdown of vehicular travel, inspection trips that previously took hours suddenly took days. Mud covered the roads, in the form of slides and slumps from rain-softened slopes and knee-deep silt left by receding waters.

While the State Highway vehicles had a well-organized radio system, it does not always function well in the mountainous terrain. Also, many telephone lines had been destroyed. It took a few days to get complete information on which to base decisions, particularly since most early efforts were devoted to opening emergency routes where possible, evacuating trapped motorists, bringing out the sick and injured, and trying to move vital supplies into isolated communities.

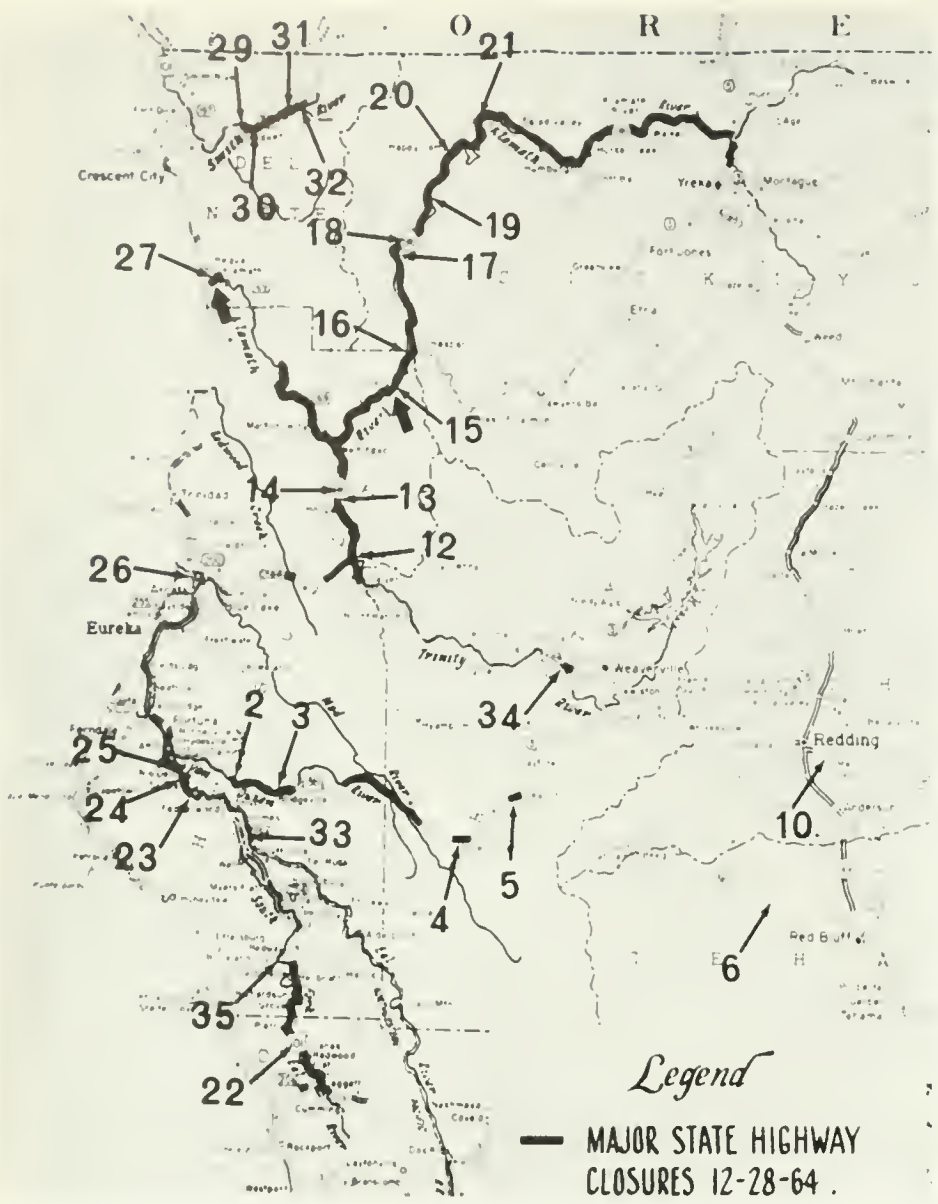
As more and more aircraft moved in, they took over these emergency transport functions. In many cases, ground transport was literally impossible, no matter how geat the effort; and had it not been for the prompt arrival of the aircraft, particularly the helicopters, there would have been much greater privation and suffering.

Helicopters and light aircraft were chartered by the Division of Highways in a number of instances to ferry in small groups of employees with the necessary authority to organize emergency contracts with whatever local equipment was available. Because this was logging country, there usually was enough.

When practicable, these "guerrillas" had radios with them for communications, but these did not always work. One engineer was dropped in at the town of Ti-Bar, far up the Klamath, and then seemed to disappear. A few days later a low-flying aircraft reported considerable truck and bulldozer activity on the roads in the vicinity, so it was assumed he was on the job.

The log emergency bridge at Willow Creek on January 7, 1965. At upper left is collapsed bridge. Photo on opposite page made same day gives aerial view of this area.

View from air of break at Willow Creek Bridge on State Route 96, emergency log bridge and collapsed bridge in center. Trinity River at lower left, town of Willow Creek and Route 299 top of picture.



Situation map, northwestern California, on December 28, 1964. Heavy lines indicate sections of severe damage. Note that all of Routes 96 and 169 are severely damaged. Numbers indicate huge slides or bridge destruction. No. 34 marks bridge destruction at Canyon Creek on Route 299, No. 2 to 6 inclusive, serious bridge or highway destruction on Sign Route 36. (See page 18.)

BELOW: Workers from various agencies clearing highway on Christmas Day. This is State Route 36 at Alton, near its western terminus. (Photo courtesy Eureka Newspapers, Inc.)

By December 24th, teams from Eureka and Redding were out on foot surveying many of the damaged sections, and reporting in by radio or telephone, whichever was most readily available. It was data from these reports added to those coming in from the maintenance stations, that began to fill in the picture of the damage so that a plan of action could be decided upon. On Christmas Day reports were in on most of the routes, and the picture was bleak.

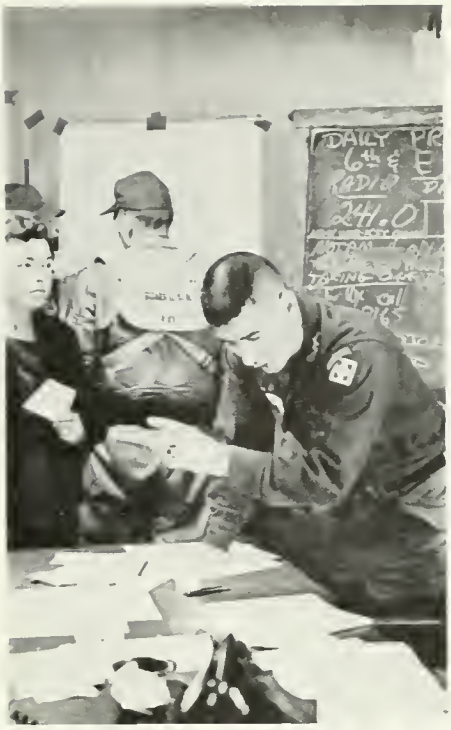
Obstacles on the Redwood Highway to the south included damage to two major bridges which made them unusable without substantial repairs, and great sections of highway washed out and slipped out farther up the Eel River, which meant weeks of laborous reconstruction. To the north the 440-foot gap in the Klamath River Bridge effectively stopped traffic, for the stream was too deep and strong for any quick, temporary bridging.

At Willow Creek, where State Route 96 joins Route 299, a bridge spanning the creek was completely destroyed, and Route 96 beyond this point was impassable at dozens of places. In addition, a number of bridges over the Klamath River were gone. Included was the state's suspension bridge at Orleans, the county's large deck truss bridge at Martin's Ferry, the Somesbar Bridge and the Forest Service suspension bridge at Ishi Pishi, near Somesbar. At best a winding, two-lane road, Route 96 had to be eliminated as an outlet possibility. For the same reasons Sign Route 36 was also eliminated.

On Route 299 there was extensive damage east of Eureka in Willow Creek canyon; six miles virtually washed away, isolating the town from the west. There was a bridge out west of Weaverville, at Canyon Creek, and massive washouts at Grey and Pony Creeks. There were several large slides as well, but compared to the Redwood Highway, the possibilities of reconstruction were much better.

It was thus apparent to the District 1 staff in Eureka that the best hope of reestablishing communications from that city to the rest of the state was via Route 299 east from Arcata

Family with sick child being evacuated by light helicopter for treatment at Eureka.



Operations center at Rohnerville Airport during the first days of operations when many rescue missions were flown.

to Redding. Since District 2 headquarters was in Redding, substantial help from that end could be depended on. The decision was made to concentrate the greatest effort on this route, with crews working on both ends, and using further emergency contracts within the stretch where possible. At the same time, efforts were continuing to organize emergency contracts on other routes, particularly the Redwood Highway, as this was a more direct route to the San Francisco Bay area.

Although Route 299 seemed the best choice for early results, this by no means meant it was going to be easy. From the Eureka end, District 1 crews struggling to replace the road base fought heartbreaking conditions. Several times big sections of the wet fill slid away into the stream, and on other occasions heavy rains caused the stream to rise and wash away the fill footings.

From the Redding end, District 2 crews struck a series of major obstacles. Each of these had to be tackled in sequence. An account of these operations gives an understanding of what was entailed in reopening the roads in these northwest mountain counties.

The first major obstacle was the 200-foot gap left by the washed-out five-span bridge over Canyon Creek at Junction City, still nearly 50 miles from the town of Willow Creek. The only possible detour, a county road and bridge upstream, was also completely destroyed. On December 24, material for a 170-foot Bailey bridge was ordered shipped to Junction City to replace the damaged bridge.

On the 25th it was decided the road could be opened more quickly by using the county road as a detour and on the morning of the 26th two tractors, one with blade and the other a blade plus ripper, were at the site ready to go to work. A drill crew of state workers arrived that morning also, and, with the tractors and drillers working as a team, by the next morning had blasted a bulldozer trail across nearby bluffs to give access to the abutments of the washed-out county bridge.

That same day two 61-foot steel beams and other necessary material for the bridge were moved in, and by 8 o'clock the next evening a one-lane bridge was ready to handle emergency traffic. The equipment was then used to widen and improve the detour road.

Although the next 30 miles toward Willow Creek had several large slides, much debris, and one large washout, it was traversable, with caution. The crews then came to a point

Breeches buoy rigged at Willow Creek Bridge to carry people across during first days of recovery after flood. Note debris and silt left by receding stream. (Photo courtesy of Eureka Newspapers, Inc.)

ABOVE: Portable drill rig in operation on Route 299 making holes for charges to blast cliff away to widen road. BELOW: Tractor and blade clearing debris from streambed to increase runoff.

Light backhoe working in snowstorm, clearing drain on Route 299.

Young highway engineers from Eureka standing by at airport as helicopter pilot loads extra gasoline for flight into Somesbar far up Klamath River. Many small groups such as this were sent by air or on foot to organize emergency road repair contracts in isolated areas.

Boulder which slid down mountainside onto Route 299 must be broken up by blasting before removal.

just east of Grey Creek where another major obstacle, actually a double one, was encountered. Here, where the road travels a ledge along almost perpendicular cliffs several hundred feet above the Trinity River, a huge rock slide had completely covered the road, and the boulders were still dropping from the high cliffs above.

An emergency contract with equipment from a local lumber company was organized, and clearing operations started. These were hampered by the rocks which showered down unexpectedly from time to time.

Five hundred feet west of this slide, drainage had clogged, and Grey Creek had cut a gap 180 feet wide and 170 feet deep across the road. Upstream a slide of millions of yards of earth precluded any chance of constructing a detour road around the opening. When the highway crews arrived, local residents had strung a rope across the ravine which enabled foot traffic to go hand over hand along the rope, wading the creek en route.

The Bailey bridge components ordered for Canyon Creek had arrived in Weaverville on the 28th on five truck and trailer units, and it was decided to use this bridge at the Grey Creek gap. Because the long units could not negotiate the sharp turns on the Canyon Creek detour, the material was reloaded onto three-axle dump trucks. This division split the bridge into 25 loads instead of 5, but by the 30th all the parts were at the site.

The Bailey was not long enough to cross the entire gap, so it was necessary to lower the approaches on either side to reduce the span. A crew had managed to build a dozer trail across a bad gap west of Pony Creek the day before, so that there were tractors available at both sides working as the bridge material was brought up.

On the night of the 30th work on excavating and leveling both approaches was finished, and at 10 a.m. on the 31st construction of the Bailey bridge began. By this time, it had been decided to first complete only a double-girder span adequate for vehicles up to 10 tons so that critically ill persons could be evacuated, with the third girder added later. This saved 36 hours, and the first vehicle crossed at 7 p.m. on January 2.

Small slide such as this on precipitous section of Route 299 can be handled by front-end loader and few trucks. This material is good for subbase and will be used for fill.

A 170-foot span across the gap had been constructed in 57 hours, and the road was open as far as Willow Creek. In the next three days an additional girder was added, increasing the capacity of the bridge to a normal 45 tons and a cautionary 60 tons.

During the entire operation the crews worked around the clock, stopping to eat and sleep when they finally were compelled to, then returning to the job. From December 28 to January 3 it rained and snowed continuously—sometimes as much as 10 inches of snow overnight. Drinking water had to be boiled, and there was no housing, although one lodge owner agreed to open up and provide meals and sleeping room. There was no electricity, and candles and kerosene lamps were necessary. A big kettle of hot soup or stew was brought to the jobs for the evening and midnight

In first days of opening emergency route, assistance from tracked tractors was necessary in places.

ABOVE: Convoy of evacuees working its way around detour on Route 299 at Junction City on December 28, 1964, over one-way bulldozer road. BELOW: Westbound convoy on Route 299 January 7, 1965, at Pony Creek. Note logs used as guardrails and delineators.

meals, and six banks of floodlights powered by portable generators provided illumination.

On the western end the District 1 crews also had been busy, although fighting the same kinds of conditions. By the 2nd of January emergency traffic could get through to Redding from Willow Creek. On the 5th a convoy system of four-wheel-drive, high-clearance traffic was started, but this was interrupted immediately. Snow in the mountains changed to rain, and the Trinity River rose six feet. Pony Creek, just west of the Bailey bridge at Grey Creek, washed out the log bridge and temporary fill there, cutting a gully 100 feet deep and 60 feet across. By 9 a.m. crews were at work on the gap, cutting trees and refilling the road, and 12 hours later trucks were moving across a newly constructed log bridge, although it was only nine feet wide over a 100-foot drop. The next day it was improved to a "good" one-way span.

The road still was open only for emergency traffic in the strictest sense —essentially four-wheel-drive vehicles or powerful units which could negotiate the deep mud and slippery grades on the hastily built road. About the same time a similar road was opened by dint of log bridges and bulldozer trails along Route 96 to the Hoopa Valley.

From this point on, with occasional minor setbacks, progress was continuous. Although there were one or two heavy rains, they did not persist, and the weather, as though repentant for its December violence, remained better than normal.

The Redwood Creek Bridge, on Route 299 west of Berry Summit, was a problem because of slide damage! A mud slide oozing down the side of the canyon actually pushed the abutment out of line, requiring recasting of broken concrete and placement of heavy rock to stop the slide. During this period the bridge damage kept load limits down to 10 tons on Route 299.

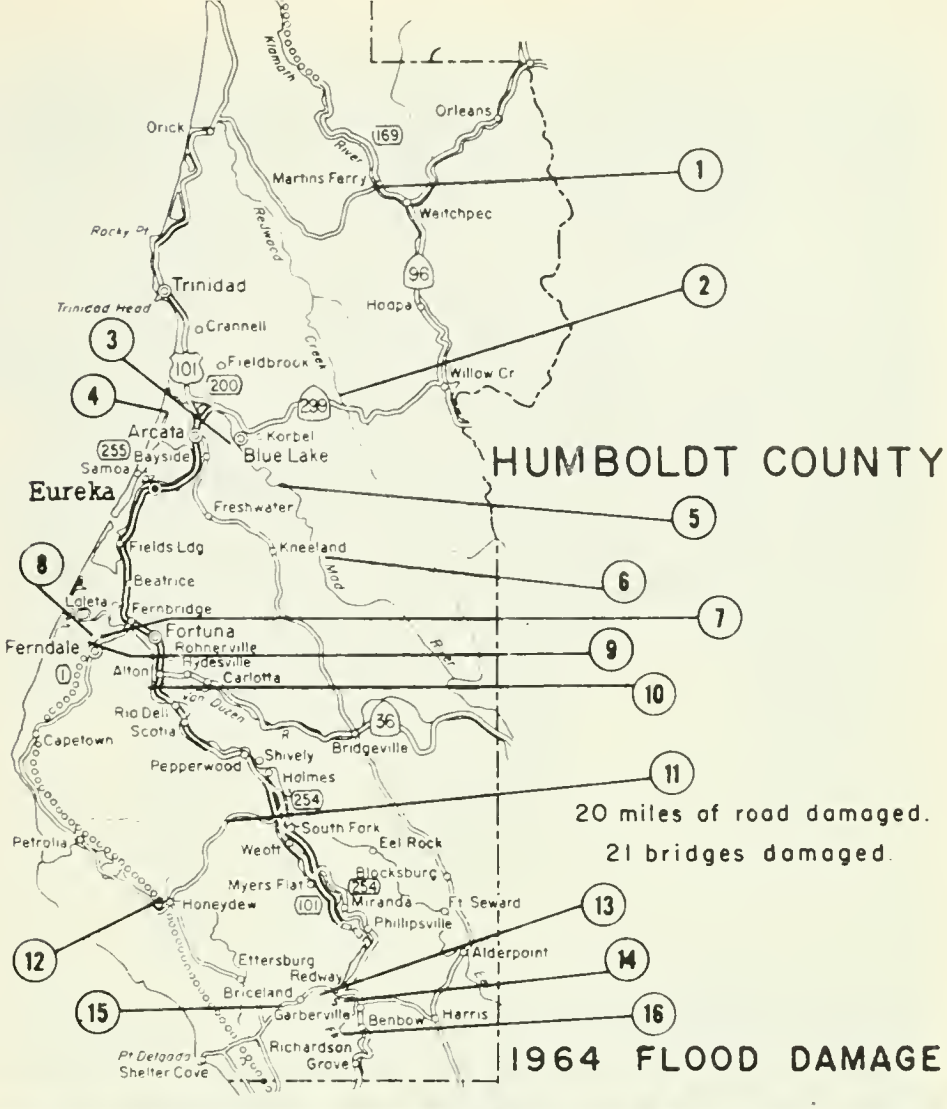
By the 15th of January the road east of Willow Creek was opened to all commercial vehicles. In daylight hours they were restricted to passage at 10 a.m., 12 noon, and 2:30 p.m. There were no restrictions at night.

On January 19th the daily convoys were doubled, leaving Berry Summit at 9:30 and 2:30; westbound from Willow Creek at 10:30 and 3:30. Passenger cars and legal loads up to 40-foot maximum length vehicle were permitted. Route 299 east of Willow Creek was opened to all traffic, subject to normal construction delay.

In the meantime the road into Hoopa Valley had been improved to take any legal load and traffic was being allowed on the same three-times-daily schedule with no restrictions at night. The road was not recommended for passenger cars.

By the 24th of January Route 299 was taking all legal traffic in the scheduled convoys, and on February 2 the schedule was dropped, traffic being convoyed each way through construction areas 24 hours a day as necessary. The traffic count was up to around 250 vehicles daily each way by this time. On weekends there were no restrictions.

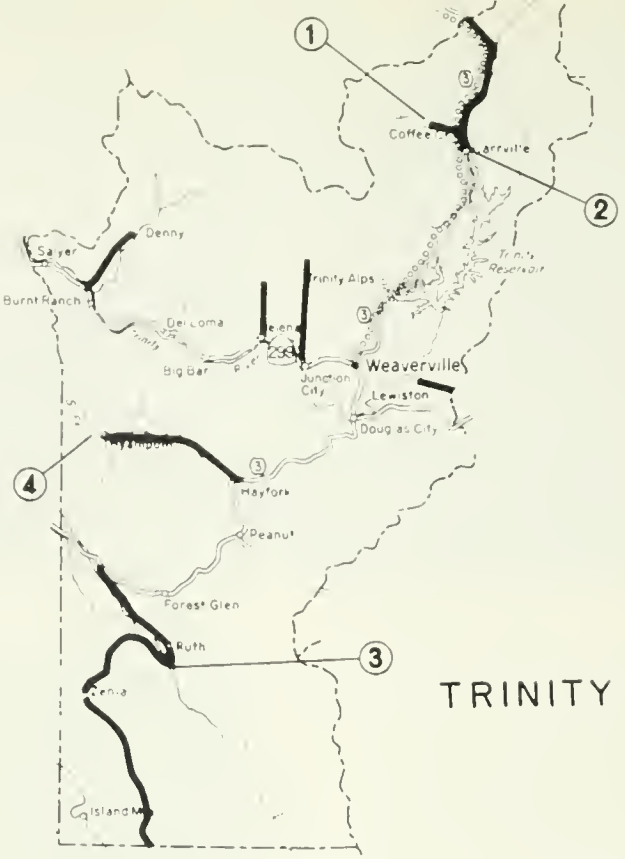
By early February both Route 299 and U.S. 101 were open to all traffic, but with convoy traffic still in effect up the Smith River Canyon on Route 199. This route was opened completely on February 14, leaving the Klamath Ferry the only interruption



On inspection flight in January to Humboldt County in Governor's plane, Highway Commissioners Abraham Kofman (left) and William S. Whitehurst are briefed on the highway situation by State Maintenance Engineer Edward L. Tinney.

Lyman R. Gillis, assistant state highway engineer for Operations, en route to flood area in Governor's plane, is interviewed by Associated Press Reporter Robert Wood.

MENDOCINO COUNTY
1964 FLOOD DAMAGE



TRINITY COUNTY
1964 FLOOD DAMAGE

10 miles of road damaged 14 bridges damaged

50 miles of road damaged 10 bridges damaged.

SISKIYOU COUNTY
1964 FLOOD DAMAGE

60 miles of road damaged. 20 bridges damaged.

n any of the main routes. The ferry as retired when repairs were completed on the Klamath River Bridge nd its was reopened to traffic on larch 14. Log bridges and use of a ortion of a logging road had also nade Sign Route 36 usable. Sign Route 96 still remained closed because f bridge destruction.

This was partly remedied by replacement of the washed out truss f the Somesbar Bridge with plate irders and reopening of the bridge n March 4. A low-level, temporary ridge was opened April 1 at Orleans, nd then Route 96 could be traversed s entire length.

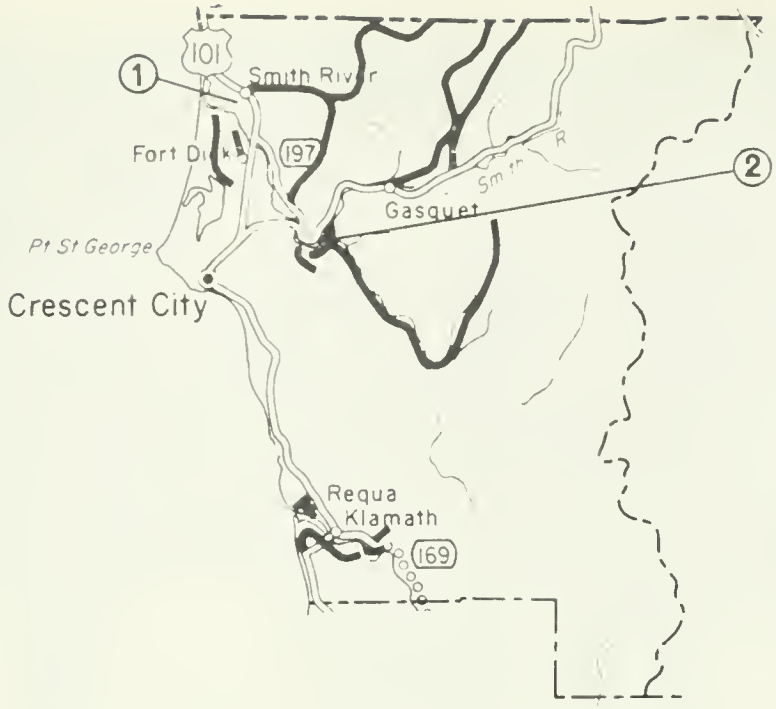
To achieve these repairs, nearly 50 mergency contracts were let, and an dditional 180 personnel were hired on he District 1 staff. Also, more than 00 individual service contracts were et to put men and equipment to work n an hourly basis. Since District 1 uffered much the greater part of the amage, this was by far the ighest number of emergency contracts in any district—the few negoiated by District 2 were mainly in onnection with reopening Route 99, in their assistance to District 1.

Bids were opened on construction f a new Redwood Creek bridge on Route 299 on new alignment March 0 and low bid was $568,648.

This is to be a 674-foot-long steel pan 110 feet above the creek bed on

In foregraund, left to right, Directar af Public Warks John Erreca and Highway Commissioners Abraham Kafman, Joseph C. Houghteling, and William S. Whitehurst look at gap in Redwood Highway narth af Ria Dell.

ELOW: Faur-span lag bridge, built as temparary replacement far destrayed bridge in faregraund, is carrying legal laads an State Raute 36 just west af Bridgeville. Piers are lag cribs filled with rack and gravel. Sectians are held tagether with steel cable.



DEL NORTE COUNTY
1964 FLOOD DAMAGE

25 miles of road damaged 5 bridges damaged.

ABOVE: First stages in construction of temporary crossing over Klamath River to replace washed-out Orleans suspension bridge. BELOW: Construction stage on replacement bridge at Somesbar. With abutments and pier intact, girders were quickly positioned to replace truss which stream carried away.

BELOW: Aerial photo of site of Highway 49 bridge across American River near Auburn. When structure, site of which is marked by dotted line, was carried away by wall of water resulting from Hell Hole Dam failure, detour road was built and emergency traffic was routed across old railroad bridge at upper right. New bridge was opened to traffic May 1, 1965.

four concrete piers. Attention was given in the design to have the bridge complement the natural beauty of its setting. A special rough-textured finish will be applied to the concrete surface of the tall piers.

On March 24 the Highway Commission allocated $1,000,000 to step up construction of the highway relocation on both sides of the bridge. On March 29 bids were advertised for this work.

On March 24 bids were opened for construction of a new bridge on State Route 96 at Willow Creek, low bid $396,693.

The cost? State repairs when recalculated firmly after all information was in, were expected to be $35,000,000, somewhat higher than first estimates. County repairs, however, were somewhat less, slightly below $23,000,000 rather than the $28,000,000 first estimated.

On March 31 both houses of the Legislature had passed and sent to the Governor for signature the Collier Bill, effective April 1, which provides for a 1-cent additional gasoline tax for nine months to collect the amount needed to defray the cost of repairs to flood damaged roads. The Governor signed it the same day. This will make the cost of the road damage about $5 for the average car owner in California.

Reconstructed Sign Route 36 in Van Duzen River Canyon. Height and extent of raw slopes indicate amount of undercutting by stream in flood.

ABOVE: Rebuilt section of Route 299 near Willow Creek, carrying normal traffic in March.

BELOW: Temporary log bridge on pilings on Sign Route 36 east of Carlotta, now carrying legal traffic loads. This is near Grizzly Creek Redwoods State Park.

At right DW-21 loaded with gravel is proceeding to fill point, and at left tractor pushes another unit as it scrapes material from river bar, rebuilding road after Christmas 1964 flood. Scene is along lower Eel River, and some of material being replaced as road base probably previous to flood was road base farther upstream!

The Redwood Highway

Rebuilding After the 1964 Flood

By JOHN ROBINSON, Information Officer

In late December 1964, after the floods subsided, the Redwood Highway north of Laytonville was no longer a highway—it was string of short pieces of local road, with no connections to the outside world. On the southern portion gigantic slides and washouts at Cummings, Leggett, Piercy and Richardson Grove effectively stopped all traffic, and farther north there were broken bridges at Scotia, Rio Dell and Robinson's Ferry. Almost all of this havoc was the work of the Eel River and its tributaries.

Northward from Eureka there were further breaks at the washed-out Klamath River Bridge on US 101 and in the total destruction of whole sections of US 199, both bridges and roadway, in the Smith River Canyon. Between these major breaks, particularly south of Eureka, there were dozens of smaller places where slides, washouts, slumps, fallen trees, and debris on the road created traffic interruptions or hazards.

It was the job of the highway employees of District 1 in Eureka to repair these places, both major and small, so that motorists once again could follow the long ribbon of the Redwood Highway true and uninterrupted the 250-odd miles from Laytonville to the Oregon state line. Equally important was the need for moving to the San Francisco Bay area

population centers the products of the northwest lumber industry. It promised to be a herculean task, particularly since the major effort first had to include the concurrent reopening of a "lifeline" route to Redding over US 299, which also, along its western sections, had suffered comparably along the Trinity River and in Willow Creek Canyon.

Although destruction was widespread on state and county roads and the area's only railroad, there were several assets. One was the pool of trained construction workers and equipment which existed because the northwestern industry was predominantly logging and lumber products. Lumber companies build their own roads, and hire many catskinners, truckdrivers, and other heavy equipment operators.

Another asset was the well-experienced group of personnel in the Eureka headquarters, many of whom had gone through the 1955 flood, and

ABOVE: Temporary one-way bridge of wooden piles, beams, and planks built across break at north end of Scotia-Rio Dell Bridge carried legal loads for several months. BELOW LEFT: Footbridge was first span over gap and served many needs for two weeks. Requirements of sign were strictly enforced by civil defense officials. BELOW RIGHT: The footbridge, a simple suspension design, being built by Pacific Lumber Co. and P.G. & E. employees. (Both lower pictures Eureka Newspapers, Inc.)

most of whom had learned to take rain and slides as part of their winter lot.

In the realm of luck was the presence of two large contractors with their staff and equipment. Best luck of all was the way the weather cooperated, once it broke in the early part of January.

In these first few days of reconstruction, everything was done with a prayer there would be no more heavy rain. The first stream crossings, low-level log bridges, were vulnerable to any rise. Substantial increases in stream velocities could sweep away in a few hours weeks of work building up road base. The weather held abnormally good, and by March much of the work had been consolidated, but was by no means out of danger.

A very valuable asset was the old concrete arch crossing at Fernbridge. Well out on the floodplain, where the force of the Eel is spent, it had stood through more than 50 rainy winters. When the waters went down, it was the only usable crossing giving access to the south.

Conceivably, the District 1 engineers reasoned, if a route could be opened from the other shore of Fernbridge over county roads to Rio Dell, and if a temporary repair could be made on the Rio Dell-Scotia Bridge, and if the massive slides and washouts could be repaired, a road of sorts

Five photos this page show steps in development of Blue Slide Road detour on Redwood Highway. Upper left is view of road on January 4 after flood; top is traffic moving in one-way convoys above cliffs before lower section repaired; directly above is filling operation on same section as shown in upper left. Directly below, about three weeks later, lumber trucks moving over this section; and bottom, same detour road where it crosses the floodplain, photographed March 17 after asphalt paving laid.

Equipment clearing debris from famous old concrete span at Fernbridge. Panel delivery under approach ramp was washed there, not parked there. This bridge was only way to get across the Eel to the south from Eureka after flood. View is from north side.

through to the south could be opened. The major piece in this connection would be a county route called the "Blue Side Road" which connected Ferndale to Rio Dell along the south side of the Eel. Unfortunately at one place a stream normally a tiny rivulet had torn a great chasm across this road, and in another place where it ran close to the shoreline, the Eel had completely removed nearly a mile, fill and all.

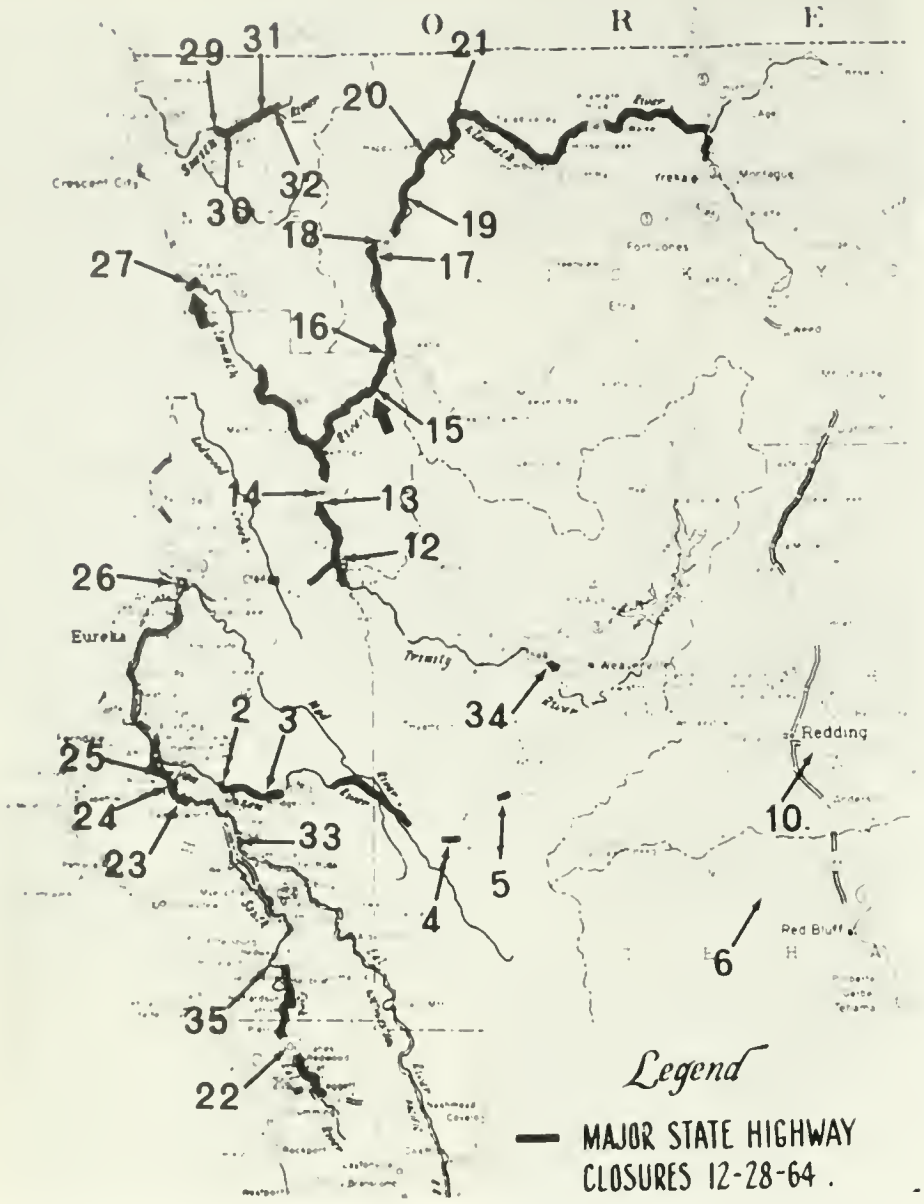
In the first few days of recovery after the disaster, while the engineers were seeking means to once again connect their bits and pieces of shattered highway, movement of people and vital supplies was exclusively by air. In Rio Dell, Scotia, and on Dyerville Bridge the paving was cleared and used for a landing strip for light planes, and something approaching a regular air service was developed. Air Force, Navy, Army and Coast Guard aircraft converged on Eureka. Although operations were marred by two helicopter crashes involving a number of fatalities, there is no doubt the death toll from the floods would have been much greater without the use of modern aircraft.

Shortly after Christmas Pacific Lumber and utility company employees built a small footbridge across the gap in the Rio Dell-Scotia Bridge. Vital materials were hand-carried across this gap, and when roads to the bridge were opened, even gasoline was transferred from one tanker to another with a long hose.

By December 27 the 49th Infantry of the California National Guard had established an emergency route from south of Cummings over the old highway up the Bell Springs grade and along the Mail Ridge route thence down to Garberville. This was the historic route established in the late 1800's and used until superseded by the present Redwood Highway. (See *California Highways and Public Works*, May–June and July–August 1964.)

Much of this route has never been improved. It is narrow, twisting, and climbs to the ridge tops over grades impossible for modern passenger cars under winter conditions. In places it travels along the edge of deep chasms, and large sections are unpaved. After the first few trips the soggy road surface became hub-deep mud. During the heavy snows around New Year's, the drifts were so deep nothing could negotiate the road, and all traffic was forced to stop.

Nevertheless, during the 17 days of operation, the guard brought in 60 tons of vital supplies to the people of



Highway situation map for northwestern California on December 28, 1964. Heavy black lines mark stretches of worst damage. Worst "side water" damage—gulleys, slipouts, slides, and washouts—on Redwood Highway was in vicinity of Nos. 35 and 22 and for several miles to the south of these points. Nos. 23, 24, and 25 were the three bridges damaged in the Scotia-Rio Dell area, No. 26 proved a minor repair problem at a bridge abutment. No. 27 indicates the washed-out Klamath River Bridge, and Nos. 29, 30, 31, and 32 mark the bad washouts and bridge destruction in the Smith River Canyon.

the Garberville area, and brought out dozens of cars of stranded motorists. In places these had to be strung out like mountaineers with tow cables to each passenger car, a military vehicle before and behind it.

On December 30 a contract was let for a temporary, one-lane span across the gap in the Scotia-Rio Dell Bridge and this was completed on January 13. In the meantime, work had been going ahead on the Blue Slide Road.

At first, traffic was forced to use an ancient, slippery, one-lane route which traversed the edge of cliffs above the Eel, while the Blue Slide section along the river was being rebuilt. Working from both ends, with 16 trucks hauling fill on the south end, and several DW-21's hauling riverbed gravel on the north, the crews had replaced the road base and had it carrying traffic in less than two weeks. Since the freeway sections through the redwoods were in relatively good shape, and there were usable bridges at all the Eel crossings south of Scotia, the road was thus open from Eureka to Garberville, but controlled by civil defense checkpoints.

In the meantime, an engineering company of the Fourth Infantry Division had rolled into Crescent City from Fort Lewis, Washington, with 84 men and 41 vehicles. In the trucks were all the parts necessary to build a combat type, pontoon platform ferry. The Office of Emergency Planning had requested their help, in the hope they could do something about the gap at the Klamath River, where the deep channel and swift current precluded any possibility of a temporary bridge. Crossings were then being made by jet boat, which had only sufficient capacity to carry small amounts of supplies and personnel.

By January 8 the Army Engineers had assembled the ferry on the north bank of the river just below the devastated town of Klamath, and State Division of Highways personnel had pushed gravel landing ramps out into the river. The craft, 93 feet long and rated to carry 65 tons, was simple. A steel framework held the six pontoons together, with a steel deck on the framework. Power came from motorboats which pushed against the downstream side, using the current to help push the ferry across the stream.

Tests were made the same day, and several stranded vehicles were ferried over, much to the delight of their drivers. The next day the ferry started regular service.

At first a log boom upstream was considered to protect the craft from drifting logs, but this proved too hazardous, and a "spotter" was stationed to warn of dangerous drift coming down. A guard boat constantly stood by below the ferry lane in case anyone fell overboard.

Rated capacity of the craft was 65 tons, but this would be under combat conditions. In view of the situation, 25 tons was set as the safe load. No vehicle was permitted to cross without a proper civil defense pass issued by either the Humboldt or Del Norte County Sheriff.

Fortunately, several contractors already had big rock trucks such as this in the vicinity, and they were invaluable in replacing road base.

Grader is engaged in cleaning silt and debris off Redwood Highway four-lane section south of Fortuna.

Boom of backhoe is used as crane for lifting sections of culvert into place while repairing washout near Richardson Grove.

ABOVE: Amount of fill required to repair such slipouts was dependent upon how far down "toe" of slope lay. BELOW: Grader, front-end loader, and dump trucks work together to remove silt in Orick, several feet deep in places, as can be seen beyond highway shoulder.

Tractor tows public utilities repair truck around bad spot at slipout on Redwood Highway. This was on December 27, 1964, during first phase of recovery from flood.

Front-end loader, assisted by tractors equipped with both blades and rippers, keeps stream of material flowing in trucks from "borrow" site selected to provide fill for washed-out sections.

Crane removes logs washed up on undamaged section of county road near Ferndale in order to use it for detour for Redwood Highway.

Maintenance crew from Idlewild on US 199 in the Smith River Canyon, clearing debris from bridge which survived the storm.

Minor slide on Redwood Highway south of Cummings being cleared by front-end loader and trucks.

Although hardly more than 100 vehicles were ferried daily during the first weeks, proficiency gradually increased. On February 18 another 30 feet was added to the ferry, and the load limit was raised to the legal highway maximum. By this time the daily lift was more than 500 vehicles.

From its first trip the little ferry caught the imagination of the press, and it got wide publicity over the state. This was well deserved, for it faithfully served traffic during daylight hours for more than two months, with only a few interruptions from river level changes.

When the pile structure filling the broken gap on the Klamath Bridge was opened March 14, the ferry was retired after an estimated 5,527 trips across the turbulent stream. During its slightly more than two months of operation, it had carried nearly 30,000 vehicles.

While somewhat less dramatic, the repair of the bridge was also a considerable feat. An emergency contract was let on December 28, but the contractor could do little except size up the job until he had materials, which had to come in from the San Francisco Bay area. On the 9th of January they came in on a barge, and were unloaded and carried by truck the 70 miles from Fields Landing to the south approaches. The barge next went to Crescent City and unloaded the materials for the north end, which needed to be trucked only 21 miles.

Work was started on the 11th of January, and the crossing was opened to traffic on Sunday evening, March 14, after almost exactly two months elapsed time. Since the temporary structure is on piles, with close spacing, it is vulnerable to damage by drift should the river rise. A deflector or buffer of piles was placed upstream for protection.

Meanwhile, on the upper reaches of the Eel scores of tractors and hundreds of dirt carriers were working. The sections south of Garberville began to come under control about the time the Rio Dell-Scotia Bridge was opened, and a few days later the first convoy of four-wheel-drive vehicles was brought through from the south. (The first convoy on Route 299 had come through on January 5th.)

Section of Redwood Highway south of Pepperwood, along main Eel River as it appeared on January 12, 1965. Dirt ridge was used like this wherever paving was destroyed to delineate safe driving area.

ABOVE: Partly rebuilt section of Route 199 in Smith River Canyon. Rock wall was for protection of fill but river rose much too high. BELOW: First truck convoy south from Eureka area on US 101 at Garberville at 2 a.m. on morning of January 16th waiting order to proceed.

Widely publicized Sixth Army pontoon ferry crossing Klamath River; ruined bridge upper left with log spotter watching upstream. Note debris on bridge. (Eureka Newspapers, Inc., photo.) Piers in background are for new highway bridge under construction.

Red Cross girl serving schoolchildren at Klamath crossing, January 8, 1965. Army pontoon ferry in background.

Klamath River Bridge with temporary repairs, opened to traffic on March 14, 1965.

When the first convoy of 48 trucks and pickups made it south from Garberville over US 101, it got big newspaper space all over the state. Leaving Garberville January 16th at 2:30 on a chill and foggy Saturday morning, the long line of rigs, preceded by Highway Patrol and Division of Highways vehicles, skirted washouts and slipouts along 200-foot cliffs for two hours in darkness and bad visibility until it arrived safely at Laytonville at the foot of Rattlesnake Grade. The only casualty was one grocery truck which sank in soft going and ripped off one of its fuel lines. Included in the convoy were several lumber trucks and a "reefer" load of Humboldt crab meat. Due to the road condition, none of these rigs were permitted to tow trailers.

Pontoon ferry landing with load of emergency utility repair vehicles borrowed from Oregon early in January. Ferry had been operating only a few days at this time. High water and current were serious problems.

That evening a similar and much larger convoy started north from an assembly point a few miles above Laytonville, and made it through without serious difficulty. Movements could be made only at night, since reconstruction work obliterated sections of the road during daylight hours.

The daily two-way nighttime convoys were continued for some time, with crews each day repairing any damage and continuing to build up and firm the road. In less than a week legal loads were allowed, and continued to move despite heavy rain in two instances.

On January 20 Mr. Larry T. Marshall of U.S. Plywood in Eureka wrote Mr. Helwer:

"Today we were greatly delighted to see the first truck and trailer load of plywood roll out of here headed south to join the convoy at Garberville. It was a small beginning, but nonetheless a hopeful one and certainly good for our spirits. Tomorrow we expect to roll five fully loaded rigs. In 10 days or so we can roll nine each day and put all of our people to work."

On the 24th the southbound convoy actually was turned back at Garberville after three inches of rain fell at Rattlesnake Summit, but traffic began moving again the next day. The same day, the North Coast Timber Association announced 12 Humboldt County mills had resumed operation in the previous two weeks and 717 persons had returned to work.

On the 26th there was a massive slide at Piercy, and all movements were held up for 24 hours until it could be cleared. By this time, passenger cars were being allowed in the convoys, and departure times at assembly points were reversed at the request of the truckers.

Two days later the convoy system on 101 south of Eureka was dropped entirely, with no restrictions on nighttime travel. On February 2 this portion of the route was opened to 24-hour traffic, subject to delays at reconstruction points, and with speed and single-vehicle restrictions on the damaged bridges at Big Dann and Cedar Creeks.

Repairs going forward on Robinson Ferry Bridge over the Eel. Crews gambled stream would not flood again this winter, and as payoff bridge will be opened to traffic in May. Wreckage of old spans lies in center foreground.

ABOVE: After first building low-level log bridge to move equipment in, contractor here, using front-end loader as crane, puts logs in place for abutment for higher level crossing. BELOW: The finished bridge, crossing Patrick's Creek, US 199.

First girders of Bailey Bridge being assembled to cross Smith River on US 199. As sections are joined they are pushed out over opening by rollers set on the little platforms. (This is bridge seen on back cover.)

There were still problems on the Blue Slide Road. The little temporary bridge at Howe Creek was rebuilt to handle two lanes and opened February 15, but trucks were still having trouble on the new fill and the slippery, steep grades just outside Rio Dell. This delayed other traffic also. On the 18th a contract for surfacing this route was awarded on a low bid of $140,220 and work started on the 19th. Until this paving was completed on March 13, truck double trailer restrictions were imposed.

Contracts for permanent repairs also have been awarded as follows:

Restoring pavement on the Redwood Highway between Rio Dell and the Mendocino county line, $93,960.

Restoring pavement on the Redwood Highway between Humboldt county line and Rattlesnake Creek, $126,720.

Permanent repairs to the Scotia-Rio Dell Bridge, $223,304.25.

Permanent repairs to the Robinson Ferry Bridge. Estimated cost $650,000 but emergency contract let January 5, 1965 on a cost-plus basis.

The contract has been let on the new Richard Fleisher Memorial Bridge at South Scotia to replace the washed-out parallel structure. This is a major bridge contract, for a four-lane bridge 1,025 feet long and with a clearance of 15 feet above the December 1964 high water. Bids were opened in Sacramento March 31, with the low bid $2,020,023. The bridge is expected to be open for traffic on December 15, 1965.

Other contracts will be let, but the road will be in good condition by the current season, with some delays at construction sites.

The other area of major damage on the Redwood Highway was the section of US 199 in the Smith River Canyon between Gasquet and Idlewild. Because of the difficulties of access, work proceeded here at a slower pace than to the south. Also, since much of the traffic on this section in winter is associated with the lumbering industry, inadequate temporary construction would not suffice.

The bridge crossing Patrick's Creek had been destroyed, and the contractor working on reconstruction from that end was authorized to build a log bridge adequate to carry legal loads until completion of already planned reconstruction of the road could be made on new alignment. Three miles south of here another bridge washout was replaced with a Bailey bridge.

In many places in the canyon reconstruction entailed virtually rebuilding the road, for where the rushing torrents struck the highway on outside curves, nothing was left. Protecting riprap was valueless, for the stream was so high it boiled right over the top of these barriers. This required replacement of many thousands of yards of fill.

As on the other routes, first movements were four-wheel-drive vehicles, followed quickly by convoys. First vehicle to traverse the road was a U.S. mail truck on the Crescent City-Grants Pass run on January 28. As the bridges and the road were improved, the convoy system was extended. By February 4, convoys were including passenger cars and single unit trucks with legal loads. Semis and trailers were excluded because they could not maneuver around the sharp turn leading onto one narrow log bridge.

On the 14th of February this condition was improved and restrictions were lifted, with the road open to all traffic on a 24-hour basis, subject to delay at construction sites. A newsman who made the trip over this road about this time reported that except for the delays at construction sites, traffic was moving as fast as ever.

On the afternoon of Monday, the 15th of March, representatives of the Greater Eureka Chamber of Commerce and the Chamber of Commerce of Del Norte County gathered at Klamath for a ceremony celebrating reopening of the bridge the night before. This was the last interruption in the roadway, and the Redwood Highway was once again a single entity.

Another Bailey Bridge replacement on US Route 199 across Smith River. This is only one girder high, but can carry legal loads by virtue of center pier.

MORE "BEFORE AND AFTER" PHOTOGRAPHS

In addition to those inside the front and back covers, these photos show "before and after" views of destruction on the Redwood Highway, and how it looks since repaired. The two upper pairs are in the Cummings-Leggett vicinity, and about two months have elapsed from "before" to "after." The lower pair shows a section of US 199 in the Smith River Canyon, first in mid-January, then about five weeks later.

Much of the work of reopening highways after a disastrous storm is like this—wet, cold, and muddy.

Kudos Tell Story

Nothing But Praise for Highway Workers

A great asset to the Division of Highways in repairing flood-damaged highways was the group of dedicated and experienced personnel in the field at the time. The tremendous effort and achievement of these workers who reopened the roads in northern California after the Christmas 1964 floods are indicated in some of the commendations issued later.

In a special memorandum to all District 1 personnel dated January 4, 1965, District Engineer Sam Helwer said in part:

"The organization and personnel of our own Division of Highways have not only responded to this emergency efficiently but also with characteristic devotion and efforts beyond the call of duty. Most of our people worked without rest, often under extremely hazardous conditions. Some of our people were dropped into isolated areas by small planes and helicopters, after which they covered many miles on foot through snow, hail, and flood in continuing bad weather in order to bring back reliable information on the extent of damage as well as recommendations for procedures on repair and restoration of facilities.

"As usual, the work of our maintenance and construction personnel has been outstanding in every way. Work has been carried on around the clock through Christmas, New Year's, and weekends, and will continue on this basis until this extreme emergency has passed. Some of our initial efforts may be nullified by additional storms that must be expected before spring; however, our efforts will continue undiminished.

"As district engineer, I am grateful to all of our people at every level who are working so hard to restore the highways so badly needed in this area. I am confident this will be done as soon as humanly possible. I am humble in the knowledge that our organization is filled with trained personnel who go to work automatically and efficiently when emergencies arise."

ASSEMBLY RESOLUTION

On February 18, 1965, the State Assembly adopted unanimously House Resolution No. 175 which included these statements:

"WHEREAS, The men of District 1 of the Division of Highways, under the direction of District Highway Engineer Sam Helwer, were faced with the awesome responsibility of maintaining the highways of the severely stricken portions of northern California during the floods of December 1964 and January 1965; and

"WHEREAS, These floods caused unprecedented damage and unfortunate loss of life; and

"WHEREAS, The loss of life and property would have been far greater except for the almost miraculous job of emergency highway repair and maintenance done by Mr. Helwer and his staff in order to keep the highways open to relief-bearing transportation; and

"WHEREAS, This exceptional job was above and beyond the call of duty and in the highest tradition of American heroism; now, therefore, be it

"*Resolved by the Assembly of the State of California*, That the members extend their highest and most heartfelt commendation to Sam Helwer and the staff of Division of Highways District 1 for their role in averting greater disaster, and express the hope that these men will continue their magnificent work; . . . "

At its February 24, 1965, meeting the California Highway Commission unanimously adopted a resolution containing these words:

"WHEREAS, Storms occurring during the latter part of December 1964 caused unprecedented floods in streams and rivers throughout northern California, resulting in tragic loss of life and heavy damage to private as well as public property, including State highways; and

"WHEREAS, Many state highway bridges were destroyed or damaged, and numerous sections of highway closed by slides and washouts, resulting in the isolation of many communities; and

"WHEREAS, The maintenance personnel, engineers and other employees of the Division of Highways of the Department of Public Works, in this grave situation, responded wholeheartedly and heroically to their duty, working long hours in adverse weather under extremely difficult and hazardous conditions;

"*Now, therefore, be it resolved by the California Highway Commission*, That it hereby expresses to these employees its sincere appreciation and admiration for their outstanding service to the people of California in this emergency, and its further commendation to them for the rapidity with which damaged state highways were reopened to public travel."

SENATE RESOLUTION

On March 2 the State Senate unanimously followed suit with Senate Resolution No. 87, which included these paragraphs:

"WHEREAS, The devastation caused by the storm resulted in the destruction or substantial impairment of all means of travel and other communication over vast areas, resulting in the total isolation of numerous communities; and

"WHEREAS, Any undue delay in the restoration of adequate means of travel throughout this vast area could have seriously aggravated the effects of this awesome disaster; and

"WHEREAS, In the true tradition of American heroism, all of the personnel of District 1 of the Division of Highways, under the most competent leadership of District Highway Engineer Sam Helwer, worked unceasingly during even the most violent period of the storm in a most gallant effort to maintain and to reopen the highways in this devastated area; and

"WHEREAS, These public-spirited state employees performed many actions above and beyond the call of duty in order to aid the citizens of the stricken communities in a number of other ways; and

Henry H. Pickrell, assistant maintenance engineer, District 2, Redding, who took charge of work opening Route 299 from the eastern end.

"WHEREAS, All of the personnel and facilities of the Division of Highways were promptly and efficiently mobilized in an all-out effort to reestablish the vital highway links into the affected area in an amazingly short period of time; and

"WHEREAS, The efforts of these state employees did much to alleviate the impact of the disaster, and did much to support the morale and confidence of the residents of the disaster area; now, therefore, be it

"*Resolved by the Senate of the State of California*, That the members warmly commend Sam Helwer and the staff of District 1 of the division for their magnificent work in averting greater disaster; . . ."

Although Division of Highways personnel at District Headquarters and in Sacramento spent long hours both in the field and in offices planning and coordinating the reconstruction efforts, the brunt of the work fell upon the men at the scene.

Without exception all highway personnel in the flood areas unstintingly gave of their time and energy, but the following examples of the work done by some of the maintenance personnel will serve to clearly illustrate the caliber of these men and their work:

Samuel A. McCush of Piercy, Retired

A random selection from the personnel files shows that as far back as

Sam Helwer, district engineer of District 1, Eureka, reports on the highway situation to local citizens and members of the Highway Commission at special meeting in January at Scotia Inn, Humboldt County.

December 1928 Samuel McCush, highway foreman, was recommended for a raise of $5 per month in salary because he was "an excellent foreman, thoroughly conversant with all phases of highway construction, including powder, bridges and oil . . . An excellent shovel foreman and above average as an organizer. He is a leader among his men and is respected by his men and the public who know him."

Sam was retired in 1954 and, when the Christmas floods of 1964 struck, had been peacefully ranching in the Piercy vicinity for 10 years. He was

Samuel McCush of Piercy, highway foreman emeritus, retired in 1954 at age of 68, organized crews and worked for 12 days without pay on the Redwood Highway to "get the road open."

then 78 years of age. Nevertheless, horrified at the state the highway was in after the flood receded, he organized men and equipment and, for the several weeks the Piercy area was isolated, labored long hours seven days a week to effect repairs. Because of his retired status, he could not expect pay for his work, and when this was pointed out to him later, he just said, "I wanted to get the road open."

In a personal "thank you" letter, J. C. Womack on February 5, 1965 commended Sam for the "excellent work you did on your own initiative during the flood which began on December 21, 1964."

Mr. Womack further said, "Your immediate and intelligent action in obtaining a small crew of men and equipment in connection with removing trees, opening culverts, and other emergency work in the vicinity of Piercy, on US Highway 101, has saved the state, according to Mr. Sam Burrows, Highway Superintendent in Garberville, between $150,000 and $200,000. Your action in this emergency is another fine example of the esprit de corps that has prevailed in the Maintenance Department for years."

Henry H. Pickrell, Assistant Highway Maintenance Engineer, Redding

With several miles of US Highway 299 completely destroyed west of Willow Creek, preventing men and equipment from Eureka getting through to make repairs, Henry Pickrell, of the District 2 office in Redding, at the request of District 1 in Eureka, took charge of operations, and working around the clock, reopened the 49 miles of US 299 east of Willow Creek.

The work included the clearance of numerous slides, filling of many washouts, and construction of three bridges adequate for legal loads. The road was opened for emergency traffic after a total elapsed time of eight days and nine hours, allowing the evacuation of sick and injured people, and the importation of badly needed food and medical supplies. During the entire operation, the workers were harassed by continuous rain and snow.

When the special congressional subcommittee visiting the devastated area commended Mr. Pickrell for his efforts, Mr. Pickrell replied "My boss, Mr. Wilson, told me to get out there and open the road. So we opened the road."

Russell Beckwith, Highway Superintendent, State Honor Camp 41, Siskiyou County

When the bridge at Clear Creek was destroyed by flood waters, Beckwith organized his personnel and materials and in four days reopened the road to Happy Camp so that his personnel might be of assistance to the town during the emergency. To do so included construction of a two-span log bridge with one 99-foot span. Beckwith was commended by the district maintenance engineer for his work.

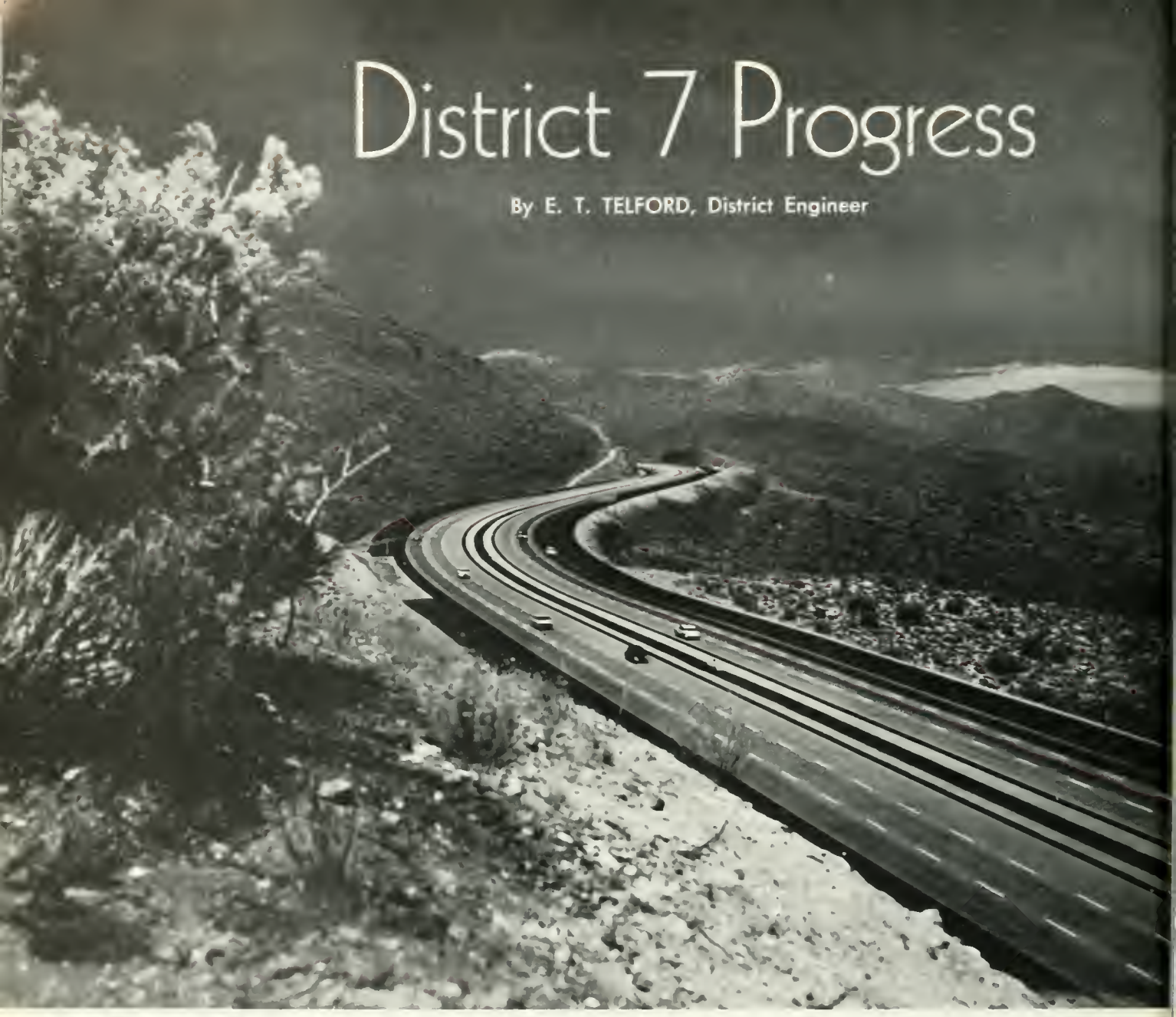
On January 18th, when this same Honor Camp 41 group was building a log bridge at Dillon Creek, Highway Foreman Bud Sheffield was knocked off the structure by a rolling log, and fell 32 feet into the creek. Injured and unconscious, he was being carried downstream by the swift current when James S. Havard, followed immediately by Jack Lee Parvin, dove into the water to rescue him. Since Sheffield is 6'5" tall and weighs about 245, the rescuers were having trouble getting him ashore, so Elmer B. Rhoades and Wayne G. Cassen also entered the stream and helped bring the unconscious man ashore. Sheffield was hospitalized with a cracked pelvic bone and mild concussion, and is presently convalescing. All four honor camp members were commended in writing by the camp supervisor, and by the State Highway Engineer in a letter of appreciation to the Director, Department of Corrections.

Mentioned in the previous issue were those highway employees who saved the bridge at Dyerville, and who discovered the washout on Interstate 5 at Meers Creek. These are only a few examples of the dedication, ingenuity and even heroism with which highway people responded to the emergency. The entire catalogue would fill many issues of this publication.

The Bailey Bridge at Grey Creek photographed on January 7, 1965, when it was already a major factar in mavement of canvoy traffic on Route 299 between Redding and Eureka.

District 7 Progress

By E. T. TELFORD, District Engineer



Among 23 finalists in Parade Magazine's 1964 scenic highway competition was this portion of the Antelope Valley Freeway which affords scenic vistas, has halved the accident rate, and quartered the fatality rate for motorists crossing the San Gabriel Mountains from Solemint.

In 1964, 30.6 miles of new freeway were opened to traffic in Los Angeles, Orange and Ventura Counties, making District 7's share of the California freeway and expressway system nearly one-third complete.

In addition, another 21.5 miles were under construction, 406 miles were in some stage of design, and 2,500 parcels were acquired for rights-of-way. Route location studies resulted in adoption by the California Highway Commission of another 111.1 miles of freeway, including the last portion of District 7's interstate system—15.4 miles of the Foothill Freeway.

Editor's note: For clarity, freeway names commonly used by the general public are utilized in this report instead of route numbers.

During 1964, more than 4,000,000 vehicles were registered in the tri-county area, about 14,000,000,000 miles were traveled on state highways within the district, of which about 9,000,000,000 miles were on freeways and expressways. Thus, although freeways and expressways comprise only 31 percent of the district's mileage, they carry nearly 68 percent of the traffic using state facilities. Furthermore, freeway travel computations have shown that motorists saved $413,000,000 during the year, including $95,000,000 in operating costs, $18,000,000 in accident costs, and $300,000,000 in time.

District 7 freeways have been highly significant in preparing for the rapid growth of the tricounty area. With the population soaring from nearly 3,000,000 in 1940 to more than 8,000,000 in 1965—and with projections of 12,000,000 by 1980—swift development of a good transportation system has been essential. But in broader perspective, what has made the freeways a dynamic force in planning for the population influx is that the accessibility they provide influences what others do with the land surrounding them. In a very real sense, the freeway system has paved the way for others to revitalize Los Angeles' central city and to develop and unify suburban and rural areas.

Photographs taken in 1933, 1953, and 1964 demonstrate the metamorphosis which occurred in Los Angeles' civic center in just over 30 years. Recently constructed modern government buildings and the new Music Center Pavilion attract ever-increasing traffic volumes to this area, as will the proposed Bunker Hill project. Without access by freeway, many of these developments would have been impractical.

Farther south in the downtown area, accessibility via the freeway loop has encouraged many companies to headquarter in the city's core, which in turn has stimulated construction of new buildings and modernization of older ones. In the past seven years, more than $100,000,000 has been spent annually for construction in the downtown area.

In addition to accessibility, the freeway loop provides landscaped "open space." In many parts of the downtown sector, the landscaped freeway furnishes the only "green" in sight. By nature of its right-of-way width, the freeway precludes the emergence of what urban planners sometimes call the "concrete jungle"—skyscrapers knit together in row after row, shutting out light and air.

In suburban and rural areas, surges in real estate development are occurring as definite plans for freeways, water, and other public necessities unfold. Currently, some of the most discernible surges are occurring in the Saugus-Newhall, Simi Valley, Orange County, and Puente Hills areas.

Spillout from the San Fernando Valley has been attracted to the Saugus-Newhall region, now served by the Golden State-San Diego Freeway complex. By 1970, this area will also be approachable via the Antelope Valley Freeway. Although development is typified primarily by single-family residences now, freeway accessibility is expected to encourage commerce and industry as the population grows.

Also experiencing spillout from the same source is the Simi Valley, an area rapidly growing in single-family residences (with the bulk of the work force commuting to the San Fernando Valley) and in commercial establishments. The proposed Simi Valley Freeway has encouraged this development to such an extent that plans must be given top priority to relieve existing traffic congestion.

In Orange County, the progress of the San Diego Freeway has precipitated rapid growth in Fountain Valley and Huntington Beach, the latter was one of the fastest growing cities in California last year. To the southeast, where the San Diego Freeway route ties into the Santa Ana Freeway, residential development has begun and is expected to continue at a steady pace with the promise of greater freeway service.

Along the route of the future Pomona Freeway, residential development is continuing rapidly in a northeasterly direction from the Whittier-La Habra region and in a southeasterly direction in the La Puente-Walnut area.

Freeway service—present and potential—has also been a major factor in locating new, planned communities. One of the largest, the 93,000-acre Irvine Ranch in Orange County, will be served by six routes: the Santa Ana, San Diego, Garden Grove, Newport, Laguna, and Corona Del Mar Freeways.

Other planned communities under development include: Laguna Niguel, which has an industrial park along two miles of the San Diego-Santa Ana Freeway and advertises the site's rapid access to both the Los Angeles and San Diego markets (1 and 1½ hours respectively); Diamond Bar, which will be served by the east-west Pomona Freeway and the north-south Orange Freeway; and Conejo Village, selected site for two colleges, an airport, shopping and industrial centers,

The downtown district of Los Angeles is becoming more metropolitan in appearance each year. With access to the central city assured by a growing freeway network, both industry and culture are better able to resist decentralization trends observed elsewhere.

which will be served by the existing Ventura Freeway and the future Moorpark Freeway.

The effect of the freeway system on land uses in areas already highly developed is equally interesting. In some instances, a freeway has caused little, if any, change in land usage, particularly where it traverses R-1 housing. In other instances, property abutting a freeway has changed from R-1 to multiple housing, or from residential to commercial, depending upon local desires. At any rate, freeway frontage has been desirable for a wide range of purposes. At random, here are just a few specific examples:

Industrial. New complexes currently being developed adjacent to at least one freeway include Cherry Avenue, El Segundo, Huntington Beach, Rancho San Pedro, San Fernando, Watson, and Whittier Narrows Industrial Parks.

Shopping Centers. In addition to several older shopping centers along the Ventura, Santa Ana, and San Bernardino Freeways, a Broadway center is currently under construction off the San Diego Freeway at Beach Boulevard, and developers are planning a 50-acre May Company-based center near what eventually will be the Pacific Coast-Huntington Beach Freeway Interchange.

Hospitals. Monsignor O'Dwyer, director of hospitals for the Archdiocese of Los Angeles, cites the freeways as being a major factor in locating the 175-bed Holy Cross Hospital (off the Golden State Freeway near Rinaldi), the 200-bed St. John's Hospital in Santa Monica (near the future Santa Monica Freeway), and the Queen of the Valley Hospital (off the San Bernardino Freeway in West Covina).

Golf Courses. Lohman & Lane have located the Arroyo Seco Golf Course off the Pasadena Freeway, the Twin Lakes Golf Course off the San Bernardino Freeway, and, on a former dump site, the Dominguez Golf Course off the Harbor-San Diego Freeway Interchange. Adjacent to the future Pomona Freeway is Los Angeles County's new Diamond Bar County Golf Course; off the Ventura Freeway near Moorpark Road is Los Robles Greens, built with 7 holes on the north side and 11 on the south side of the freeway. Golfers will cross under the freeway via a tunnel.

The Ventura Freeway in Burbank passes near such diverse facilities as Forest Lawn (top), Walt Disney Studios (left center), Providence High School and St. Joseph's Hospital (center), and Buena Vista Park.

Construction of Angel Stadium is flanked by the Santa Ana Freeway (visible at top) and by the artist's conception of the future Orange Freeway (in foreground).

Sports and Sightseeing Centers. The Angel Stadium, scheduled for opening in 1966, will be served by the Santa Ana and future Orange Freeways, as is the Dodger Stadium by the Pasadena and Golden State Freeways. The proposed site for the Hollywood Museum is accessible from the Hollywood Freeway, and the Greater Los Angeles Zoo will lie adjacent to the Golden State and Ventura Freeways.

Residential. At a recent California Real Estate Association meeting, John Klug, president of Pacesetter Homes, stated that he seeks properties adjacent to freeways for his developments. Custom homes have been rising off the San Diego Freeway in the Santa Monica Mountains ever since that freeway was opened in December 1962. New multiple units have been constructed along almost every freeway in the tricounty area, such as along the one-mile section of the Ventura Freeway between Woodlake and Mulholland Drive.

Hotels. Opened in December 1963 was the 156-room, 6-story Hyatt House off the Santa Ana Freeway at Washington Boulevard. Off the San Diego Freeway at Burbank and Sepulveda Boulevards is the new Carriage Inn.

J. M. Hooper, assistant vice president for Holiday Inns in the 11 western states, says that all nine locations for his hotels in the Greater Los Angeles area lie near freeway interchanges and that these are decidedly the "preferred locations."

Considerable public interest was evident at the October 1 dedication of this 9.5-mile section of the San Diego Freeway which links Los Angeles and Orange Counties. About 1,000 people were in attendance.

1964 Freeway Openings

Although the 30.6 miles of freeway opened to traffic during 1964 fall short of the record 54 miles completed in 1963, the mileage is consistent with the district's five-year average of 30 miles opened per year since 1959. All but 4.7 of the miles completed during 1964 are on interstate routes, bringing the district's interstate share to 237.2 miles, or 73 percent of the 324 miles planned.

The longest stretch opened in 1964—and one of the most heavily traveled—was 11.3 miles of the San Diego Freeway (Interstate 405) between the Long Beach Freeway and Bolsa Chica Road in Seal Beach. Completed from the Long Beach Freeway to Atlantic Avenue in January, and partly completed from Atlantic to Bolsa Chica in October, this segment has greatly improved access between Los Angeles and Orange Counties. An average of 75,000 vehicles a day, peaking to 90,000 at Atlantic Avenue, are using this new stretch of freeway at a time savings of approximately one-half that required for a comparable trip via surface streets.

Another interstate opening which aroused considerable public interest occurred last fall when the first substantial link of the Santa Monica Freeway (Interstate 10) was completed between Vermont Avenue and La Cienega Boulevard, a distance of 4.6 miles. This section averages 90,000 vehicles a day, swelling to 128,000 at Vermont Avenue.

Farther west on the Santa Monica Freeway, a one-mile link between the San Diego-Santa Monica Freeway Interchange and Bundy Drive was opened late in December. This event allowed partial use of the interchange for the first time and improved access to the San Diego Freeway.

The first mileage to be opened on the San Gabriel River Freeway (Interstate 605) was completed last June. This three-mile stretch between Whittier Boulevard and Peck Road, added to a 3.9-mile stretch opened last fall between Peck Road and the San Bernardino Freeway, marks the beginning

This segment of the San Diego Freeway serves the Long Beach Municipal Airport via Lakewood Boulevard. The view is west across the freeway, showing the Willow Street undercrossing.

The view looking eastward on Route 126 shows the interchange with Interstate 5 in the Castaic Junction-Saugus area.

The Santa Monica Freeway stretches ribbonlike toward the Pacific Ocean as viewed from the cloverleaf interchange at La Brea Avenue.

of a new outer loop around Los Angeles. Approximately 36,000 vehicles a day are now using this mileage.

Approximately three miles of the Golden State Freeway were partly converted to full interstate standards late in December with the opening of northbound lanes on a segment between Saugus Junction and a point three miles south of Castaic. Several contracts will be awarded in the next few years to complete conversion of this route (Interstate 5) between Los Angeles and the Kern county line.

Construction of nearly 100 new miles and widening of more than another 50 during the next seven fiscal years should bring District 7's portion of the interstate system to completion by the 1972 deadline. Expenditures for the interstate mileage alone will run approximately $346,000,000 for construction and $149,000,000 for rights-of-way.

Noninterstate openings during 1964 included three portions of the Garden Grove Freeway: a 1.6-mile stretch from Manchester Avenue to Main Street through the Santa Ana Freeway interchange, opened in January; a 0.7-mile segment between Beach Boulevard and Garden Grove Boulevard, opened in July; and another 0.7-mile segment between Manchester and Haster Street, opened in November.

Also opened during 1964 was a two-mile portion of the Newport Freeway from the Santa Ana Freeway to Warner Avenue.

Traffic Diversion and Volumes

While sufficient time has not elapsed to complete full-scale studies, initial traffic counts on these new freeways indicate that they are attracting considerable traffic from (and easing congestion on) many surface streets.

Preliminary checks show that the Santa Monica Freeway between Vermont Avenue and La Cienega Boulevard, for example, may be drawing sizable volumes from paralleling streets as far away as Olympic Boulevard, which lies a mile to a mile and a half

1963 AND 1964 AVERAGE DAILY TRAFFIC

	1963	1964
Hollywood Freeway		
Westerly of the Four-level Structure	185,000	181,000
South of the Ventura Freeway	98,000	110,000
Harbor Freeway		
South of the Four-level Structure	188,000	187,000
At 30th Street Overcrossing	193,000	196,000
At Century Boulevard	136,000	145,000
At San Diego Freeway	63,000	72,000
San Bernardino Freeway		
West of the Golden State Freeway	78,000	80,000
East of the Long Beach Freeway	158,000	159,000
Santa Ana Freeway		
East of Rosemead Boulevard	112,000	116,000
West of Long Beach Freeway	180,000	180,000
Pasadena Freeway		
North of Four-level Structure	92,000	96,000
North of Golden State Freeway	86,000	94,000
Santa Monica Freeway		
Harbor Freeway to Santa Ana Freeway	112,000	120,000
Ventura Freeway		
East of Hollywood Freeway	50,000	65,000
West of Hollywood Freeway	157,000	160,000
West of San Diego Freeway	133,000	143,000
Golden State Freeway		
North of East Los Angeles Interchange	116,000	120,000
West of Pasadena Freeway	130,000	140,000
North of Ventura Freeway	95,000	97,000
Long Beach Freeway	*1963*	*1964*
At Pacific Coast Highway	57,000	62,000
South of Santa Ana Freeway	89,000	98,000
South of San Bernardino Freeway	48,500	54,000
San Diego Freeway		
West of Long Beach Freeway	74,000	96,000
At Harbor Freeway	84,000	102,000
At Olympic Boulevard	125,000	142,000
At Ventura Freeway	105,000	117,000
Colorado Freeway		
At Linda Vista	28,000	27,000
Glendale Freeway		
At Golden State Freeway	35,000	42,000
Riverside Freeway		
At Santa Ana Freeway	50,000	59,000
Using Four-level Structure during a 24-hour weekday	333,000	343,000

north of the freeway. These early counts reveal a 25-percenr decrease in Olympic Boulevard traffic since the freeway's opening, and the figure runs as high as 44 percent for parallel streets closer to the freeway.

The extent of traffic diversion from specific surface streets is not as easily discernible elsewhere, however. For example, while it is known that some 90,000 vehicles a day are being diverted to the San Diego Freeway between Atlantic Avenue and Bolsa Chica Road, it is not apparent just where this traffic is coming from. In this instance, the freeway moves diagonally across existing surface streets and may be relieving both east-west and north-south streets to some extent.

An interesting analysis currently underway is the attracting power of the San Gabriel River Freeway between the San Bernardino Freeway and Whittier Boulevard. Much of the current freeway traffic may be a diversion from Workman Mill Road, a circuitous two-lane facility with many sharp curves. While the freeway may be affording some relief to Rosemead Boulevard on its west, it is probable that its power to divert from this major artery will be considerably greater when the freeway is extended farther south to the Santa Ana Freeway.

Overall, average daily traffic volumes on the District 7 freeway network increased approximately 5 percent during 1964. A one-year comparison at several strategic locations indicates where traffic is increasing or decreasing (see chart above).

Planning Studies

A number of major planning studies were accomplished during 1964 to evaluate current traffic volumes such as those discussed above and to analyze traffic patterns for determination of present and future needs.

Two of these studies will be incorporated into the State Highway Engineer's report to the 1965 Legislature: (1) a review of the state high-

The San Gabriel River Freeway serves the City of Industry. This view is looking north.

Seattle Public Library
MAY 25 1965

way system, including the California freeway and expressway system—the first since its adoption in 1959, and (2) a deficiency report on all district freeways and highways. The first report recommends deletions, additions, and technical changes in the freeway and expressway system; the second estimates the minimum expenditures necessary between July 1, 1967, and June 30, 1971, to meet future traffic demands.

Many man-hours were devoted during 1964 to the Los Angeles Regional Transportation Study (LARTS), which transcends district boundaries, and considers the total transportation needs of the area.

Among primary activities was preparation of an agreement to establish a formal relationship among the jurisdictions participating in the study—Los Angeles, Orange, Ventura, San Bernardino, and Riverside Counties, the 123 cities within the region, the Southern California Rapid Transit District, and the Highway Transportation Agency. These participants, along with the U.S. Bureau of Public Roads and the U.S. Housing and Home Finance Agency, have been working cooperatively—but informally—since January 1960 to determine present and future transportation needs within the region by relating movements of people and goods to the distribution of land use, population, employment, and other factors. The formal agreement is expected to be ratified shortly, in compliance with the Federal-aid Highway Act of 1962.

Also in preparation during 1964 was an appendix to the LARTS Base Year (1960) Report, which was completed in 1963, and a brief report containing projections of 1980 population, employment, and land use, along with the resultant travel patterns they will help determine.

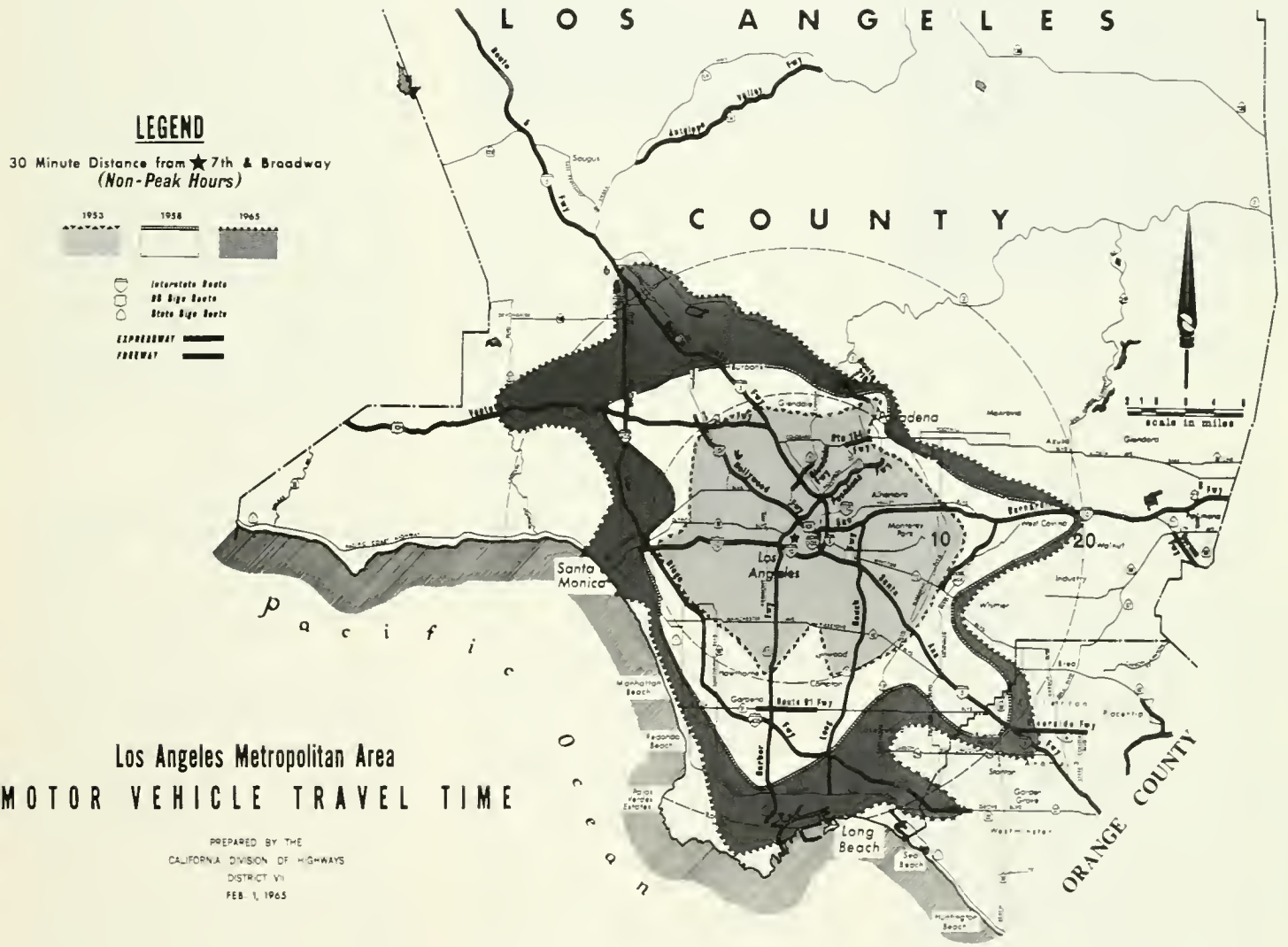
LARTS-developed techniques for assignment of future traffic to specific freeways and surface streets were used by the district for the first time dur-

ing 1964. The resulting traffic estimates are of particular value to the route planning staff, which has the responsibility of conducting studies for the precise location of all routes in the California freeway and expressway system.

Route planning studies last year culminated in the adoption of 111.1 miles of freeway by the California Highway Commission, a figure more than double the average over the past several years. Included in this mileage were the final links of the Foothill, Long Beach, Route 126, Simi Valley, and Moorpark Freeways, as well as a major portion of the Pacific Coast Freeway and a route commonly known as the Oxnard Bypass. Collectively, these portions will represent a future expenditure of $438,100,000, with $269,900,000 for construction and $168,200,000 for purchase of rights-of-way.

Seven public hearings were held by the district on these and other freeway segments during 1964, three public hearings were held by the California Highway Commission.

As of 1964 yearend, 60 percent of the district's freeway system had been adopted, and nearly half the remaining mileage was being studied. Under active study were the Beverly Hills, Huntington Beach, Industrial, and Malibu-Whitnall Freeways, and portions of the Pacific Coast, Century, Hawthorne, and Route 150 Freeways, as well as the final segments of the Garden Grove, Marina-Slauson, Artesia-Riverside, San Gabriel River, and Route 138 Freeways.



A massive bridge column farm dwarfs construction men at work building the Long Beach-Pomona Freeway Interchange. When completed in the fall of 1966, this structure will be the second four-level interchange in Los Angeles.

Right-of-Way

Right-of-way acquisition progressed steadily throughout the year on the 406 miles of freeway adopted but not yet under construction. In excess of 2,100 separate parcels were certified for acquisition, another 2,600 were appraised, and still another 2,500 were purchased. In addition, appraisal estimates for route planning studies were completed on 55,725 parcels.

Nearly $80,000,000 was expended for rights-of-way in 1964. Largest amounts went for the Foothill Freeway (approximately $14,500,000, the Glendale Freeway ($11,000,000), Route 134 Freeway ($10,500,000), the Orange Freeway ($6,600,000), and the Pomona Freeway ($4,400,000).

Other expenditures included over $3,500,000 for relocation of utilities—public, quasi-public, or private—in preparation for freeway construction.

A new policy was initiated last year to speed clearance and cleanup of land prior to freeway construction. The new procedure has reduced the length of time a row of empty houses is allowed to remain in a neighborhood. It also provides for cleanup of vacated lots and for their maintenance until start of construction. The program has greatly reduced vandalism on state property during this phase of freeway development.

Contruction

Construction contracts awarded during 1964 totaled 159 at a dollar value of $86,200,000, of which 26 contracts called for freeway construction at a cost of $72,700,000. Completed during the year were 151 jobs at a cost of $89,400,000, including 16 freeway projects costing $64,300,000. Dollar value of all construction projects underway averaged $154,600,000 a month, peaking to $162,600,000 during August.

Notable developments in improving, transporting, and producing concrete for paving operations were advanced during the calendar year. As a check on the use of expansive cement without transverse joints (a test employed during 1963 on a portion of the Antelope Valley Freeway), a 1.5-mile stretch of the Santa Monica Freeway was paved with regular cement and no transverse joints. Preliminary reports indicate that use of expansive cement does result in slower and less random cracking, but existing standards of placing make either method impractical for widespread use at the present.

Expanded use of central mix plants and tilt-bed trucks for transporting low-slump concrete was employed by several contractors last year with successful results. Also proving useful for placing material on the San Diego Freeway was a low-profile batch plant in Long Beach. Production of one-inch high-quality-slump concrete averaged about 2,800 cubic yards per day, with a high of 4,200 cubic yards (or enough material for 6,000 lineal feet of 24-foot-wide pavement).

Bridges and other structures under construction during 1964 totaled 130, including 30 along the Santa Monica Freeway alone. Major structures completed were the San Bernardino-San Diego Freeway Interchanges. The last of these employed a new concept in bridge design, featuring a three-span continuous curved girder. At the end of the year, this type of construction was being used in several other locations.

Improvements to existing freeways during the year included installation of 31 miles of chain link and 7 miles of metal beam median barriers at a cost of approximately $680,000.

Landscaping

In a continuing effort to beautify existing freeways and to blend them into the surrounding neighborhood, District 7 awarded 19 contracts during the year for landscaping and related work such as installation of irrigation systems. The contracts covered 388.5 acres along 38.5 miles of freeway at a cost of $1,500,000, up nearly a half-million from 1963 expenditures.

Approximately $700,000 of the money allotted went for four contracts along the San Diego Freeway. One contract, for $400,000, was the second largest landscaping project ever awarded in California and called for placement of 1,500,000 ground cover plants, nearly 5,000 trees, and over 8,000 shrubs between El Segundo and La Tijera Boulevards.

Other jobs included work at the Ventura-Ojai and Ventura-Route 126 Freeway Interchanges and at five other places along the Ventura Freeway.

Signing and Signals

In accordance with 1963 legislation which renumbered several state routes in this district, approximately 1,700 route shields were replaced between April and June along freeways and other state facilities. In addition, 300 overhead and 160 roadside signs were modified to show the new numbers. Cost of the program was $45,000.

Upgrading the signing on all state highways in the district was continued throughout the year with completion of a project on the Hollywood Freeway between the Four-level Inter-

change and Sunset Boulevard, and with preparation of plans for resigning 16 miles of the Santa Ana Freeway between the San Bernardino Freeway and the vicinity of Firestone Boulevard, a job now underway.

Generally included in the upgrading are more advance warning signs of upcoming off-ramps, greater use of freeway names to supplement route numbers and destinations, and wider use of overhead signs.

In an effort to reduce last-minute lane changes when a righthand lane ends at an interchange, yellow "EXIT ONLY" overlays were affixed to overhead signs at five freeway-to-freeway interchanges on an experimental basis.

A new signing program was also initiated at on-and off-ramps to discourage wrong-way driving. Red and white "WRONG WAY" signs are being posted at all off-ramps, and green and white "FREEWAY ENTRANCE" signs will indicate all on-ramps. Reflectorized pavement arrows will supplement these signs.

During 1964, District 7 also completed signalization plans for 48 intersections on conventional highways and for 51 intersections near freeway construction. Signals were modified at another 311 locations. Total cost of the signalization program was $3,350,000.

Maintenance

Maintenance costs rose as expected during the 1963–64 fiscal year with new freeway mileage and landscaping additions. Expenditures reached $9,200,000, a 3½ percent increase over the 1962–63 fiscal year.

Major expenses were incurred for general maintenance and routine repairs ($2.2 million), landscape maintenance ($1.7 million), maintenance of traffic signals and lights ($1.3 million), and sweeping and hauling ($1 million).

Median barrier repair cost nearly $480,000 and required 43 full-time and four part-time employees. Several experiments are underway to reduce the frequency with which these barriers are hit and damaged, including use of reflectors on fence posts and as edge-of-pavement markers. A new aluminum mesh is being tested (in place of chain link fabric) to reduce headlight glare.

Landscaping along the district's older freeways is sufficiently lush to make this unmistakably a southern California scene. The foliage along the Hollywood Freeway through Cahuenga Pass provides a pleasing view for motorist and freeway neighbor alike.

New Materials Lab

A $406,000 materials laboratory was officially opened June 3, adjacent to the Santa Monica Freeway viaduct near Maple Avenue. The new dust-free, air-conditioned facility was designed to streamline the testing of soils, mineral aggregates, and other construction materials. Testing productivity has risen 40 percent over 1963.

Coaperative Projects

Because of 1963 legislation which increased revenue available to cities and counties for streets and roads, and which revised allocation of the funds, the district's city-county projects activity was more than doubled during 1964.

Of the money available under the Federal-aid Secondary Program, the district reviewed and administered plans for projects amounting to $351,000 in Los Angeles County, $181,000 in Orange County, and $333,000 in Ventura County. Another $600,000 was allocated to Los Angeles County and the City of West Covina under the Federal-aid Secondary Urban Extension Program for construction on Azusa Avenue. An additional $2,800,000 went for railroad separations on Downey Road and Reseda Boulevard-Parthenia Street.

Chain link fencing takes beating from 70 to 75 times a month, requiring extensive fence repair by maintenance crews. This crew is patching a section of the San Diego Freeway near the airport.

The changing face of Los Angeles Civic Center—1933,

DISTRICT PROGRESS FREEWAY BY FREEWAY

Antelope Valley Freeway (Route 14)

Steady construction and design progress was made during 1964 along this 52-mile route between the Golden State Freeway near San Fernando and the Kern county line.

Opened in 1963 for 14.4 miles between Soledad Canyon Road near Solamint and Ward Road Overcrossing, current construction will extend the freeway 7.6 miles easterly to Angeles Forest Highway near Vincent by this summer.

The next contract to be let will carry the freeway from Vincent 5.9 miles north to Avenue P8 in Palmdale. This job has been advertised, and will be 16 months in construction.

Still another project to be advertised this fall is a first-stage grading job between Avenue I in Lancaster and the Kern county line, a distance of eight miles.

Five other projects are tentatively scheduled for construction in the next few years to complete the Antelope Valley Freeway throughout in District 7. (See *California Highways and Public Works*, January–February, 1964.)

Artesia-Riverside Freeway (Route 91)

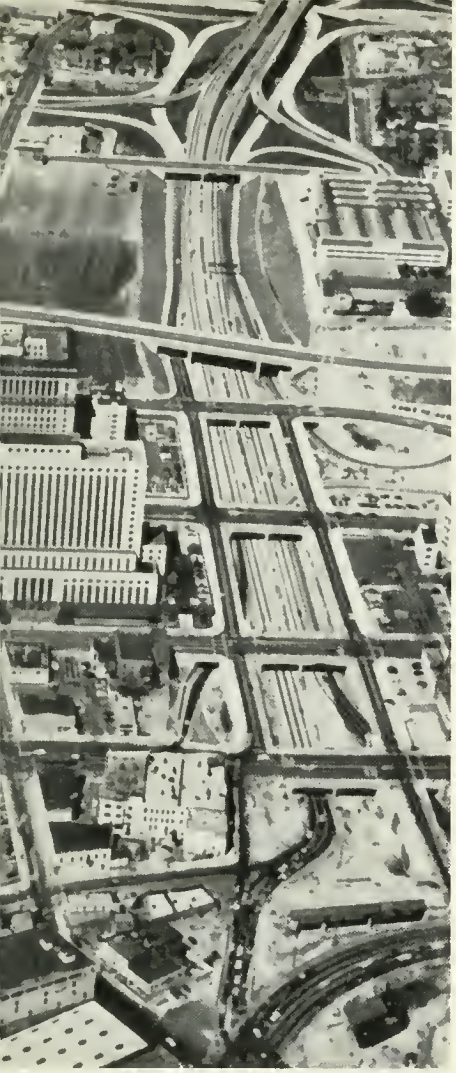
From the San Diego Freeway in the Lawndale-Torrance area, this route will extend 49.5 miles almost due east in District 7 to the Riverside county line.

Moving from west to east, status of projects along the route is as follows:

From the San Diego Freeway to Normandie Avenue, route location studies are in preliminary stages on the only unadopted portion of the freeway in District 7.

Normandie Avenue to Alameda Street is an expressway now, and conversion to full freeway is expected in the next several years. A first-stage contract at an estimated $750,0000 will be underway this summer on a one-mile section in the slough area between Normandie and Vermont Avenues. This project was advanced in the construction program to cooperate with the City of Gardena in eliminating unsanitary conditions caused by the slough along the freeway's path. The state is also cooperating with Gardena in developing a park on land which will be excess property after the freeway is constructed.

From Alameda Street to the Santa Ana Freeway, seven projects are in design. One construction project is



1964.

underway between the San Gabriel River and Studebaker Road in connection with the Artesia-San Gabriel River Freeway Interchange.

From the Santa Ana Freeway to Placentia Avenue in Anaheim, the route is full freeway now. Construction is currently underway to widen it from four to six lanes between Lemon Street and Placentia Avenue in Anaheim, and to convert it from four-lane expressway to six-lane freeway from Placentia to the Newport Freeway.

Two other projects are in design to convert the remaining expressway mileage to full freeway from the Newport Freeway to the county line.

Late in 1964, an important improvement was made to the facility with completion of a $1,200,000 interchange at Dowling Avenue in Anaheim. This interchange is greatly improving service to traffic generated by the North American Autonetics Division plant and other industries in the area.

Foothill Freeway (Interstate 210, Route 30)

The 15.4-mile section of the Foothill Freeway adopted November 18, 1964, by the California Highway Commission completes adoption of the route for its entire 52.2 miles in this district. The freeway will begin on the north at the Golden State Freeway near Sylmar, run southeasterly to Pasadena, and then almost due east through the San Gabriel Valley to the San Bernardino county line.

Only 1.6 miles of the freeway route are open to traffic—a section north of Pasadena between Hampton Road and Montana Street, constructed prior to inclusion of Route 210 in the interstate system. The next construction scheduled on the route will be 2.5 miles in the Monrovia-Duarte area. The $2,200,000 project, which will be under construction by next fall, will call for construction of eight structures, and for embankment; paving operations will follow under a subsequent contract.

At yearend, approximately $37,500,000 had been spent for rights of way along the route, including the $14,500,000 expended in 1964 in the San Gabriel Valley.

Sixteen separate contracts are presently scheduled for contract award by the 1970–71 fiscal year in order to complete the interstate portion of this route on time.

An unusual design feature in parts of Pasadena and Arcadia will be the utilization of one corridor for two public transportation facilities—the freeway and a railroad. In Pasadena, from Marengo Avenue to Wilson Avenue, the main line of the Atchison,

The present eastern terminus of the Antelope Valley Freeway is located at Ward Road Overcrossing in foreground. In photo center, the freeway construction crosses over Red Rover Mine Road.

Topeka & Santa Fe Railway is to be depressed alongside the freeway. In Arcadia, from Eaton Wash to Santa Anita Avenue, the railroad will be relocated in the freeway median.

Garden Grove Freeway (Route 22)

Except for 2.2 miles at this route's western end, the Garden Grove Freeway is complete, under construction, or budgeted throughout its ultimate 17 miles (2.5 of which are coincident with the San Diego Freeway). An east-west route, this freeway will eventually connect Pacific Coast Highway in Long Beach with the Newport Freeway in Orange County.

Moving from west to east, the freeway's status is:

From Pacific Coast Highway to the San Diego Freeway, construction is tentatively scheduled during the early 1970's.

For approximately 2½ miles easterly, the Garden Grove Freeway is nearing completion in conjunction with a project on the San Diego Freeway. Both routes will utilize the same 11- and 12-lane roadway along this stretch.

From the San Diego Freeway to Garden Grove Boulevard near Knott Avenue, a contract was recently awarded to extend the freeway another 2.5 miles. Completion is anticipated in spring of 1966.

From Garden Grove Boulevard, near Knott Avenue, to Newland Street, a 1.5-mile project was completed last June. Traffic is now using 0.7 mile of this portion, with the remaining mileage to be opened upon completion of the adjacent project to the east.

From Newland Street to Garden Grove Boulevard near Haster Street (a distance of 4.7 miles), three projects costing $9,400,000 are under contract and are scheduled for completion late this year.

A one-mile section between Haster Street and Manchester Avenue was opened last November.

The 1.6-mile segment between Manchester and Main Street in Santa Ana was completed under two contracts late in 1963 and early in 1964. This project included the Garden Grove Freeway interchange with the Santa Ana Freeway.

The final contract between Main Street and the Newport Freeway, a distance of 1.9 miles, will be underway before 1965 ends.

Golden State Freeway (Interstate 5)

This important interstate route will ultimately run from the East Los Angeles Interchange to the Kern county line, a distance of nearly 72 miles in District 7. The route is now continuous as a freeway from the East Los Angeles Interchange to Sierra Highway, a distance of 28.4 miles. From there to the county line it is largely an expressway.

Current emphasis is on conversion of the route to full freeway standards in northern Los Angeles County. During 1964, one project was opened to traffic, another was put into construction, and eight others were in design.

Opened were the northbound lanes
a 3.3-mile job between Saugus
nction and a point three miles south
Castaic. The $5,600,000 contract
cluded construction of a one-mile
ortion of the Route 126 Freeway at
s interchange with the Golden State.

Put into construction last Novem-
er was a four-mile segment from the
ern county line south. This $5,500,-
00 project will be completed late in
966.

A total of six projects, all scheduled
r advertising in the first half of
965, will continue the conversion an-
her 26.5 miles. Three contracts are
r first-stage grading and structure
ork, with final paving projects to
llow in the next few years. These
ree jobs will involve the largest
rth moving operation in California
ghway construction history, as the
ute moves through the mountains
Angeles National Forest and re-
uires removal of 45,000,000 cubic
ards of roadway material. The other
ree contracts will provide full free-
ay between Sierra Highway and
ugus Junction and from future
oute 138 near the Kern county line
a point 6.8 miles south.

Among improvements planned on
e existing freeway south of Sierra
lighway is the addition of auxiliary
nes between Colorado Street and
Western Avenue, a distance of about
vo miles, in the vicinity of Griffith
ark. The job will be advertised this spring in conjunction with a project to build the Golden State-Route 134 Freeway interchange.

On the drawing board is another project which will introduce a new concept of handling truck traffic in Los Angeles. In the area where the Foothill, Golden State, and Antelope Valley Freeways will converge, trucks will be routed to roadways separate from those carrying passenger cars. This design is considered necessary because of extremely high truck traffic volume within the interchange complex.

Harbor Freeway (Route 11)

Complete for 22 miles from downtown Los Angeles to Battery Street in San Pedro, the Harbor Freeway will eventually be extended southerly to its interchange with Route 7 just west of the Vincent Thomas Bridge.

During 1964, a freeway agreement was reached with the City of Los Angeles for this extension, and design plans are well under way. All of the right of way requirements for the project have been determined, and about 25 percent of the needed property has been acquired.

Hollywood Freeway (Routes 101, 170)

Extension of this route from its present northerly end at Magnolia Boulevard in North Hollywood to its ultimate terminus at the Golden State Freeway in Pacoima should be accomplished late in this decade.

uality and uniformity for freeway construction materials require testing. This new materials laboratary is located adjacent to the Santa Monica Freeway viaduct near downtown Los Angeles.

During 1964, a first-stage embankment contract was let along 3.7 miles of the route between Laurel Canyon Boulevard and the Golden State Freeway.

From Magnolia Boulevard to Victory Boulevard, a contract is currently underway with a target date for completion set late in 1966.

Farther south on the Hollywood Freeway, a first-stage widening project on outbound lanes between Franklin Avenue and the Pilgrimage Bridge (a distance of 1.3 miles) is nearing completion. The $681,000 contract calls for adding of one lane to the existing three. Design plans are in progress for adding an outbound lane between Sunset Boulevard and Franklin Avenue and another inbound lane from the Pilgrimage Bridge to Sunset Boulevard. Completion of these projects will eliminate all existing three-lane roadway sections on the Hollywood Freeway.

Long Beach Freeway (Route 7)

Determination of the routing for five miles of this freeway through El Sereno, South Pasadena and Pasadena by the California Highway Commission last November 18 completes the adoption of the Long Beach Freeway throughout its 26-mile length.

With the opening of a 1.1-mile segment between Valley Boulevard and the San Bernardino Freeway early this year, the existing route now extends 20.7 miles.

A project will be advertised this summer to increase capacity from six to eight lanes between Olympic Boulevard in East Los Angeles and Bandini Boulevard in Vernon, a 1.4-mile section that includes the route's interchange with the Santa Ana Freeway. Cost is estimated to be $2,500,-000.

Two subsequent contracts will extend this widening from Bandini to the San Diego Freeway, a distance of 12 miles. Combined cost of the projects is estimated at $3,800,000.

Marina-Slauson Freeway (Route 90)

This east-west route, which will be situated almost midway between parallelling Santa Monica and Century Freeways, will stretch approximately 20 miles between the future Pacific

The northward extension of the Long Beach Freeway has brought a new interchange with the San Bernardino Freeway into being. Now open to traffic, the route provides convenient access to California State College at Los Angeles (left center).

The Hollywood Freeway is also being extended. This view shows construction north of the interchange with the Ventura Freeway.

Coast Freeway on the west and the San Gabriel River Freeway on the east.

First contract on the route, which will be awarded this summer, calls for a $3,500,000 project for structures in the San Diego-Marina Freeway Interchange. A second contract in the interchange area will be let in the spring of 1966. Its completion will result in a usable length of freeway between Slauson Avenue and Centinela Boulevard, a distance of 1.5 miles.

Final design of the 1.8 miles from Centinela west to Pacific Coast Freeway is dependent on the adoption of the latter freeway segment.

East of the San Diego-Marina Freeway Interchange, preliminary studies are underway to locate the remaining 18 miles of the freeway, which is popularly known as the Slauson Freeway.

Moorpark Freeway (Route 23)

The 17-mile Moorpark Freeway will provide a north-south link between the Santa Paula Freeway in Fillmore and the Ventura Freeway in Thousand Oaks, skirting the community of Moorpark near its midpoint.

On October 29, the California Highway Commission formally adopted the last portion of this freeway between three miles south of Tierra Rejada Road and the Santa Paula Freeway, a distance of 13.4 miles. The entire route, including a major interchange with the Simi Valley Freeway, is now in design.

Newport Freeway (Route 55)

This route was extended another two miles southward during 1964 with the opening of a segment between the Santa Ana Freeway and Warner Avenue. The freeway is now complete from the Riverside Freeway to Warner Avenue, a distance of 9.2 miles.

Bids were opened on April 1 to continue the four-lane freeway another 3.9 miles south to Palisades Road-Bristol Street. This project includes the San Diego-Newport Freeway Interchange. Two other projects are in design to complete the final stretch between Palisades-Bristol Street and Pacific Coast Freeway. Total length of the ultimate route is 17.5 miles.

Ojai Freeway (Route 33)

The Ojai Freeway will eventually stretch 57.5 miles from the Ventura Freeway in Ventura to the Santa Barbara county line near the Cuyama River. The freeway is open to traffic from the Ventura Freeway four miles north, is budgeted for construction another three miles north to Casitas Pass Road in Foster Park, and is adopted for still another eight miles north to Cozy Dell Canyon.

The three-mile project recently budgeted will be let early in 1966 and will cost about $2,800,000.

Orange Freeway (Route 57)

This north-south route will stretch some 30 miles from the Foothill-San Bernardino Freeway just east of Pomona to the Pacific Coast Freeway near the Santa Ana River, crossing the Pomona, Century, Riverside, Santa Ana, and San Diego Freeways in the process. It will directly serve the Kellogg Campus of California Polytechnic College, Mount San Antonio College, Pomona and other communities in eastern Los Angeles County, linking them into central Orange County.

The route of the Orange Freeway is adopted for 19.4 miles from the San Bernardino Freeway to the Santa Ana Freeway, and design is well underway in eight separate projects. To date, $17,100,000 has been spent for rights-of-way including $6,600,000 expended in 1964.

Pacific Coast Freeway (Route 1)

Adoption last September of a 23.3-mile segment of this route between the Calleguas Creek in Ventura county line and Malibu Canyon Road brings the mileage adopted on Pacific Coast Freeway to 45.1, exclusive of the five

miles which are now open from Pleasant Valley Road to Calleguas Creek, where the route is a full freeway.

This route, the longest in the district, will eventually parallel the coastline from the Ventura Freeway north of Oxnard to Serra Junction in Capistrano Beach, a distance of 114 miles.

Beginning on the north, a 4.1-mile segment of the Pacific Coast Freeway was adopted from the Ventura Freeway to a point near Pleasant Valley Road last June 24 as part of the Oxnard Bypass.

From Calleguas Creek to Malibu Canyon Road, some 24 miles of the route are adopted and currently in design.

Between Malibu Canyon Road and Beach Boulevard in Huntington Beach, with exception of a 10-mile stretch in the South Bay area of Los Angeles County, five route location studies are now underway.

Ten miles of Pacific Coast Freeway between Beach Boulevard and MacArthur Boulevard in Newport Beach are in preliminary design.

Route location studies are underway from MacArthur Boulevard to the freeway's terminus at Serra Junction.

Pomona Freeway (Route 60)

This route will stretch 30 miles through Los Angeles County, beginning at the East Los Angeles Interchange and entering San Bernardino County in the vicinity of South Pomona. When completed, it is expected to provide considerable relief for the San Bernardino Freeway.

The Pomona Freeway is under construction or budgeted under six major contracts from the East Los Angeles Interchange to Jellick Avenue in Industry, a distance of nearly 20 miles, or two-thirds of its ultimate length.

Beginning at its western terminus, these are the active projects:

East Los Angeles Interchange to Third Street, near Downey Avenue, a distance of two miles, has been under construction since October 1963 and is scheduled for completion this fall under an $8,000,000 contract.

Third Street to Woods Avenue, a 1.4-mile stretch including the freeway's interchange with the Long Beach Freeway, was put into construction last July. The $9,000,000 project will be finished in the fall of 1966.

Woods Avenue to Arroyo Drive, near San Gabriel Boulevard, is included in the 1965–66 budget. The 4.2-mile job, expected to cost approximately $5,800,000, will open to traffic in late 1966 or early 1967.

Arroyo Drive to Peck Road, a distance of three miles, was included in the 1964–65 budget. This contract should be completed late in 1966 at a cost of about $4,600,000.

Peck Road to Workman Mill Road, a 2.8-mile job including the interchange with San Gabriel River Freeway, will be completed late in 1966 at a cost of approximately $5,000,000.

Workman Mill Road to Jellick Avenue, a distance of 7.7 miles, will be advertised this summer. Estimated cost is $9,000,000; estimated completion date is fall of 1967.

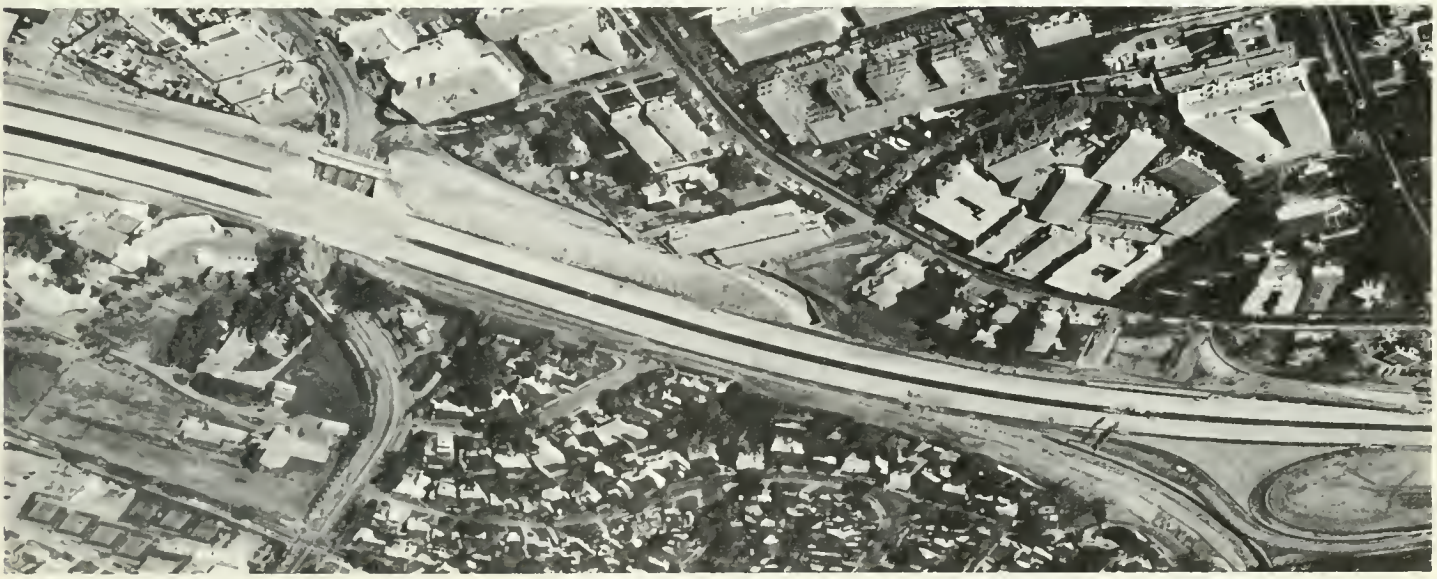
The remainder of the route in District 7, from Jellick Avenue to the Riverside county line will be constructed under three separate contracts.

Route 134

Unofficially known as the Ventura Freeway extension in the San Fernando Valley, and as the Colorado Freeway extension in the San Gabriel Valley, this route will eventually extend from the Golden State Freeway near Griffith Park 8.1 miles east to an interchange with the Foothill and Long Beach Freeways in Pasadena.

A first-stage contract, calling for a structure at Jackson Street in Glendale and the westerly extension of Monterey Road from Kenwood Street to Brand Boulevard at Burchett Street, is nearing completion. This $265,000 project will aid in handling traffic during construction of the main freeway project in Glendale.

Design is virtually complete for the Route 134-Golden State Freeway In-



The newest stretch of the Santa Monica Freeway (from La Cienega Boulevard to the San Diego Freeway) was opened January 29.

Completion of Interstate 5 in the Castaic Junction area leaves the older US 99 (on left) for frontage access. Truck-weighing facility is in foreground.

A resolution by the City Council of Los Angeles (below) honors the designer of the Santa Monica-San Diego Freeway Interchange, Mrs. Marilyn Reece, associate highway engineer.

The Cities of Orange and Santa Ana are serviced by the recently completed interchange of the Garden Grove Freeway with the Santa Ana Freeway.

The last contract to be let on the Santa Monica Freeway takes this route seaward. The project in Santa Monica will be completed this fall.

City of Los Angeles Resolution

WHEREAS, MRS. MARILYN REECE is the first woman associate highway engineer in the entire California State Division of Highways, and

WHEREAS, Engineering in itself has always been considered particularly in the realm of men and Mrs. Reece, by her ability and creative imagination, has made a breakthrough for women in this masculine endeavor, and

WHEREAS, Since 1957 she has headed a team of designers working on the Santa Monica Freeway, and

WHEREAS, The 90-acre swirl of roadways and overheads that form the West Los Angeles Interchange of this freeway is the project design of Mrs. Marilyn Reece, and

WHEREAS, She is credited with the creation and supervision of the overhead and off-ramp design of this West Los Angeles Interchange, and

WHEREAS, Her contribution to the design of this interchange with its momentous economic, social and visual impact on our community makes an important peak in the achievement of outstanding women;

NOW, THEREFORE, BE IT RESOLVED, That the Los Angeles City Council, by the adoption of this resolution, hereby commends Mrs. Marilyn Reece for her outstanding ability and accomplishment as an associate highway engineer, and thanks her for contributing to the safety, utility and beauty of our city.

terchange which will also serve the proposed Greater Los Angeles Zoo in Griffith Park.

Design plans for another major interchange, the Route 134-Glendale Freeway structure, were completed during 1964, and design of the balance of the route is well underway.

Easterly of the Glendale Freeway through the community of Eagle Rock, the freeway will be located mostly on sidehill terrain. With aesthetics in mind, the freeway will be built as a split-level roadway, with fill slopes landscaped to blend into the area through which it passes. The Eagle Rock itself, an historical landmark, will be preserved.

Between Avenue 64 and Orange Grove Avenue in Pasadena, the existing Colorado Freeway will be widened from four to eight lanes. In consideration of Annadale Country Club on the north and the business and residential development on the south, retaining walls will be used to avoid the necessity of acquiring additional right-of-way.

San Bernardino Freeway (Interstate 10 and 110)

Several major improvements are in the design stage to increase capacity along this 30-mile freeway, which has been in service for a number of years.

Most ambitious of these projects is an $11,000,000 expansion job between the Golden State and Long Beach Freeways, a distance of 3.5 miles. Design plans are currently underway to convert the present six-lane section to 10 lanes, with an additional two auxiliary lanes between Soto Street and Herbert Avenue.

Another improvement in the City Terrace area is construction of a pedestrian overcrossing to replace existing subterranean crossings used frequently by children attending the Harrison Street School. The $150,000 project, which is jointly financed by the state and county, will rise over the Pacific Electric Railway, the freeway, and Ramona Boulevard.

Central mix concrete is deposited in slipform paver, thus expediting construction of Garden Grove Freeway. This section of freeway—from Harbor Boulevard to Haster Street—is now complete.

Farther west, a $485,000 contract is now in progress to modify the Vincent Avenue Interchange in West Covina. This work is necessitated by the rapid growth in the area and resulting traffic congestion.

There are plans to widen the San Bernardino Freeway from six to eight lanes between Puente Avenue in Baldwin Park and Holt Avenue in West Covina, a distance of 5.6 miles, and between San Dimas Avenue in San Dimas and the San Bernardino County line, a distance of 6.3 miles.

San Diego Freeway (Interstate 405 and 5)

Major strides were taken during 1964 toward completion of this 93.7-mile interstate route which will eventually extend in this district from the Golden State Freeway north of San Fernando to the San Diego County line at San Clemente.

Two openings during 1964 make this route continuous for 52.1 miles from the Golden State Freeway to Bolsa Chica Road in Orange County.

Opened during 1964 were 1.8 miles between the Long Beach Freeway and Atlantic Avenue, during January; and 9.5 miles from Atlantic to Bolsa Chica Road, during October.

Of the remaining 20.6 miles to be completed, 9.1 miles are being constructed under the following three contracts:

Bolsa Chica Road to Beach Boulevard, 4.1 miles, estimated for completion this fall under an $8,100,000 contract.

Beach Boulevard to Brookhurst, 3.2 miles, construction began in January under a $7,400,000 contract and should be completed in the summer of 1966.

Brookhurst to Harbor Boulevard, 2.2 miles, work began early this year under a $5,400,000 contract and should be completed in the fall of 1966.

Design is in progress on the remaining 11.5 miles, which will be built under four separate contracts.

Two other projects are currently in design to widen the existing four-lane freeway to eight lanes between Laguna Canyon Road southeast of Irvine and the San Diego county line.

San Gabriel River Freeway (Interstate 605, Routes 243 and 240)

Construction activity is in full swing on the interstate portion of this route, which extends from the San Bernardino Freeway at Baldwin Park to the San Diego Freeway near Seal Beach.

During 1964, nearly seven miles of freeway, built under two contracts, were opened between the San Bernardino Freeway and Whittier Boulevard. The first, a 3-mile segment from Whittier Boulevard to Peck Road, was opened June 10. The second, a 3.9-mile link between the San Bernardino Freeway and Peck Road, was opened this fall in stages.

Contracts currently going between Whittier Boulevard and the San Diego Freeway are:

Whittier Boulevard to Telegraph Road, 3.2 miles, scheduled for completion this summer under a $6,100,000 contract.

Telegraph Road to Cecilia Street, 1.8 miles, scheduled for completion this summer under a $6,700,000 contract.

Cecilia Street to 166th, 3.6 miles, scheduled for completion early next year under a $7,000,000 contract.

A westward view of construction on the Pomona Freeway shows how the new route leads into the East Los Angeles Interchange where it will connect with several major freeways.

166th to 183rd, one mile, a $5,100,000 contract which includes an interchange with the Artesia Freeway, scheduled for completion in the summer of 1966.

183rd to the Orange county line near the San Diego Freeway, 4.3 miles, scheduled for completion in the spring of 1966 under a $7,000,000 contract.

Noninterstate segments will ultimately extend the San Gabriel River Freeway to the Foothill Freeway on the north and to the Pacific Coast Freeway on the south, a length of about 30 miles.

(See *California Highways and Public Works*, July–August 1964.)

Santa Ana Freeway (Interstate 105 and 5 and Route 101)

This route, operational as full freeway for several years, links downtown Los Angeles with Orange County. The Santa Ana Freeway officially terminates at its juncture with the San Diego Freeway route just southeast of Irvine, a distance of 43 miles.

Under a continuing program to increase capacity and improve traffic service, a 10.1-mile stretch between Main Street in Santa Ana and Laguna Canyon Road was widened from four to six lanes during 1964.

Currently underway is a $990,000 project to improve the Katella Avenue interchange in Anaheim near the future Angel Stadium. This project should be complete in the spring of 1966, just prior to the stadium's opening.

Modernization of another interchange will start in about a year at Stanton Avenue in Buena Park. The $250,000 job primarily involves replacing a left-hand on-ramp with a right-hand connection.

Santa Monica Freeway (Interstate 10)

Completion of two contracts and partial completion of another in 1964, and the completion of still another contract in January of this year, make this route continuous from the East Los Angeles Interchange to Bundy Drive in western Los Angeles, a distance of approximately 14 miles.

The remaining portion of the final contract, awarded in February 1964, is scheduled for completion late this year, affording motorists a beeline route of some 16½ miles between downtown Los Angeles and Santa Monica. This final project, between Bundy Drive and the west portal of the Santa Monica Tunnel, should be in operation by the end of 1965—less than four years after the first portion of the Santa Monica Freeway was opened in the East Los Angeles Interchange.

Opened to traffic during 1964 were:

A 4.6-mile segment between Vermont Avenue and La Cienega Boulevard. This stretch was opened by stages in October and November, following dedication ceremonies October 22.

A one-mile portion from Bundy Drive to the San Diego-Santa Monica Freeway Interchange, an opening that permitted partial use of the interchange, which had been completed last August. This segment is part of a 3.6-mile, $7.7 million contract to carry the freeway to the Olympic Tunnel.

The opening of the 2.5 miles between La Cienega Boulevard and Overland Avenue in January 1965 made the interchange fully operable and provided uninterrupted freeway from downtown to west Los Angeles.

Drawn in at the right is the planned route through Santa Susana Pass. The first project on the Simi Valley Freeway will be advertised for bids this fall.

Simi Valley Freeway (Route 118)

Decisions last year on alignment for 35.8 miles of the Simi Valley Freeway completed this route's adoption throughout—from the Santa Paula Freeway on the west to the Foothill Freeway on the east, a distance of 53.4 miles.

Adopted were:

Ventura County: 4.9 miles between the Route 126 Freeway and La Vista Avenue on June 24, and 19.3 miles between La Vista Avenue and First Street in Simi on December 16.

Los Angeles County: 11.6 miles in the San Fernando Valley between DeSoto Avenue and the Foothill Freeway on September 1.

Funds were budgeted for construction of a 4.5-mile segment which will link Ventura and Los Angeles Counties through the congested Santa Susana Pass. This project, the first to be scheduled on the route, will be underway this fall and will include extension of Santa Susana Avenue and widening it to four lanes between the freeway and Devonshire Street. A total of $9,500,000 has been allotted for the work, which will require excavation of about 8,000,000 cubic yards of earth. Contract limits are from near DeSoto Avenue in the west San Fernando Valley to Kuehner Drive in the east Simi Valley.

An adjoining project to the west, from Kuehner Drive to Tapo Street, a distance of three miles, is tentatively scheduled for construction during the 1966–67 fiscal year, subject to future budgeting. It is anticipated that the two freeway projects can be timed for nearly simultaneous completion, thus providing 7.5 miles of freeway service to the community of Santa Susana within a few years.

Meanwhile, traffic relief will be afforded on paralleling Los Angeles Avenue under two contracts running from Smith Road to Tierra Rejada Road, a distance of 8.5 miles. This facility will be widened from two to four lanes by late 1966. Estimated cost is $1,100,000.

Ventura Freeway (Routes 101, 134)

The Ventura Freeway, which will run 75.4 miles from the Golden State Freeway west to the Santa Barbara County line in District 7, is built to full freeway standards in the city of Los Angeles.

During 1964, six projects were put under construction or completed to bring the freeway to full standards between the west city limits of Los Angeles and Thousand Oaks in the Ventura County area. Completed were the Kanan Road and the Triunfo Road Interchanges; under construction were the Craftsman Interchange, Calabasas Overcrossing, Old Ventura Road Interchange, Rondell Park Interchange, Agoura Road Interchange, Hampshire Road Interchange, and Live Oak Undercrossing.

From Thousand Oaks northwesterly to a point near the Route 126 Freeway, a series of design projects are in preparation to complete conversion to freeway standards and to improve the existing freeway facilities. These projects include an improvement of the Borchard Road Interchange; addition of freeway interchanges at Cunningham, Lynn and Ventu Park Roads, Wendy Drive, Reino and Arneill Roads; expansion of Las Posas Road Interchange; and conversion of a three-mile segment to six-lane freeway between Vineyard Avenue and Telephone Road. Constructed in this area were the Central Avenue and Garden Acres Interchanges.

From the Route 126 Freeway to two miles beyond the west city limits of Ventura, the freeway is built to full standards. From that point northwesterly to the Santa Barbara county line, 10.5 miles of freeway are in design, including conversion of 3.5 miles of expressway to freeway.

In Los Angeles County, design is in progress to widen the freeway from six to eight lanes between Topanga Canyon Boulevard and the west city limits of Los Angeles.

STATUS OF DISTRICT 7 FREEWAY-EXPRESSWAY PROJECTS

SUMMARY AS OF JANUARY 1, 1965

Freeway or expressway name	Route number	Miles adopted	Open to traffic	Under construction	Expended to date in $1,000's
Antelope Valley	14	52	14.7	7.7	24,065
Artesia-Riverside	91	37.7	19.8	..	49,128
Beverly Hills	2	..	..	..	..
Century	42	..	..	..	..
Corona	71, 210	8.8	4.8	..	1,197
Corona del Mar	73	6.8	2.2	..	798
Foothill	210, 30	52.2	1.7	..	36,365
Garden Grove	22	14.8	5.3	6.6	37,506
Glendale	2	12	2.5	..	26,290
Golden State	5	71.6	71.6	..	164,881
Harbor	11	22.4	22.1	..	104,880
Hawthorne	107	..	..	..	..
Hollywood	101, 170	16.1	11	..	69,092
Huntington Beach	39	..	..	..	..
Industrial	47	..	..	..	..
Laguna	133	8.2	2	..	673
Long Beach	7	26	19.6	1.1	59,688
Malibu-Whitnall	64	..	..	..	..
Marina-Slauson	90	2.8	..	..	3,288
Metropolitan Bypass	138	21.8	..	..	..
Moorpark	23	17	..	..	168
Newport	55	17.5	13.7	..	24,090
Ojai	33	14	4.1	..	4,803
Orange	57	19.4	..	..	13,407
Ortega	74	..	..	..	..
Pacific Coast	1	45.1	11.4	..	11,011
Pasadena	11	8.2	8.2	..	10,785
Pomona	60	30.3	..	3.5	50,698
Reseda	14	..	..	..	..
Rio Hondo	164	0.9	0.7	..	791
Route 48	48	14.9	..	..	..
Route 126	126	49.5	5.1	8.6	19,503
Route 134	134	8.2	2.3	..	56,709
Route 150	150	..	..	..	..
Route 232	232	2.4	..	..	..
San Bernardino	10, 110	30.6	30.6	..	59,881
San Diego	5, 405	93.7	73.1	11.3	270,098
San Gabriel River	605, 240, 243	28.1	6.6	15.3	89,464
Santa Ana	5, 105, 101	43.1	43.1		99,261
Santa Monica	10	16.2	11.9	4.3	181,593
Seaside	7	2.1	1.5		19,864
Simi Valley	118	47.1	..		30
Ventura	101, 134	75.4	67.3		121,376
Yorba Linda	42	3.1	3.1	..	2,517
Totals	..	920	460	58.4	1,613,880

Equal Opportunity

Training Sessions Based On Governor's Code

By MICKEY MATSUMOTO, Assistant Training Officer

While the ink was still drying on the Governor's Code of Fair Practices, the Division of Highways took steps to implement the new code among its nearly 17,000 employees.

In September 1964, the Division of Highways became one of the first state agencies with a statewide management training program focused on equal opportunity employment. As this program got underway, State Highway Engineer J. C. Womack reemphasized the long established policy of the division's equal employment practices, by saying ". . . We have been successful in implementing both the letter and the spirit of the code so far, but projects such as this are excellent insurance that all our employees and those who seek employment with us will continue to receive fair and equitable treatment."

What, then, is equal opportunity employment? What does it mean in terms of hiring practices?

Equal opportunity means just what it says. It is assuring that all employees and applicants are appointed, assigned, trained, evaluated, and promoted on the basis of merit and fitness. Race, color, religion, national origin and ancestry have no bearing in these matters. In the division it means the continuing practice of hiring the best qualified person for the job. In order to appreciate the emphasis this program is receiving, we have to start with the basic principles of social responsibility.

State Assumes Leadership

As an agency of society, the state government has assumed leadership in solving difficult human problems. Specifically, each individual, as a part of society, has an obligation. California has been successful in dealing with many complex problems, but has never stopped striving for improvement. Equal opportunity employment is a reflection of this drive.

Opening a training session on equal opportunity employment at the District 3 headquarters in Marysville, Mickey Matsumoto of Headquarters Training Section talks to a class which includes (facing camera, left to right) District Engineer W. L. Warren, Assistant District Engineer R. E. Biggs, Construction Engineer M. E. Nelson and Assistant District Engineer H. F. Sherwood.

In July 1963, the Code of Fair Practices was issued as the official policy of California's executive branch. It carried with it an outline of positive steps to be taken by all agencies. Among these steps was a requirement for training in the areas of equal opportunity employment and human relations.

In December 1963, Governor Edmund G. Brown called a two-day workshop on equal opportunity in state service. Deputy directors, training and personnel officers from 45 state departments discussed methods of implementing the code. The conclusions reached by the participants led to recommendations and suggestions on how best to avoid pitfalls and, more important, identified areas in which statewide efforts should be concentrated. As a result of the workshop, Ray Varley, assistant director, was appointed human relations coordinator for equal opportunity employment in the Department of Public Works. In the Division of Highways, Scott Lathrop, engineer in charge of personnel and public information, was appointed the division human relations coordinator. With these appointments, the division training section set to work on the task of planning and developing an effective training program. This was in the early months of 1964.

Training Objectives

All through these beginning stages, efforts were directed toward forecasting resistances to the program and planning training objectives. It was known, for example, that there were basic resentments concerning this sub-

ject matter over and above those which are normally anticipated for any general training program. Some managers did not feel training in this area was needed. Moreover, they objected to what some considered an implication that they were not already practicing equal employment principles in their jobs. Most did not have the sense of urgency that stems from an awareness of the problems. Reaction seemed to be in terms of "they," "them," "you" and "others," rather than on an "I" or "we" basis.

Still another barrier was the risk of implying "preferential treatment" rather than equal opportunity employment. The training staff attempted, as much as possible, to anticipate these resistances and resentments. Ultimately, these efforts were rewarded.

Program objectives were to: (1) *Allay fears and concerns among employees about what organizational policy would be.* For example, it was clearly outlined that reverse discrimination was not the intent. (2) *Motivate managers to think, talk about, and act on racial issues.* Too many individuals felt that racial issues were either not to be discussed, or only a subject for philosophical discussion rather than for positive action. (3) *Introduce pertinent social science findings on a practical rather than an academic level.* Initial reaction to the subject of equal opportunity employment indicated a lack of knowledge in this area. (4) *Insure full application of the code on the job.*

Extensive Research

In order to meet these objectives, extensive research was conducted through personal contacts with experts in the field of human relations. Library research presented an almost overwhelming amount of literature that had to be read and screened before a single word of training material could be prepared. The course material was written and rewritten, always keeping in mind the importance of its objectives.

The end result was a seven-hour training session. Prior to these sessions, literature in the area of social sciences, as related to cultural differences, was studied by the persons who would participate. The training session itself concentrated on the ethnic composition of our work force, completion and discussion of quizzes, and case problems relating to actual work situations. By means of these training methods, participants were able to test and improve their ability to apply division policy and philosophy to their jobs. Free discussion in the session also allowed the participants to express their feelings and concerns, and to resolve any misunderstandings of the reading unit or of the policy.

Course Introduced

The course was introduced on September 23, 1964, to the management of District 5 in San Luis Obispo, and was completed in Sacramento Headquarters on January 14, 1965. More than 500 employees participated in the training, from district department heads to the State Highway Engineer. Thus, all persons responsible for hiring practices and enforcement of the policy attended. Also represented were members of the director's staff, managers and staff department heads from the Division of Bay Toll Crossings, and from the Division of Contracts and Rights of Way. Each manager and participant was asked to carry back to the job the basic philosophy of equal opportunity employment, knowledge of the division's policy and motivation to take positive action to carry out the code.

The training was reemphasized by Mr. Womack in a personal letter to each district engineer throughout the state. The letter asked for a personal commitment on the part of each district engineer and requested that he issue a letter to all employees on the pertinent points outlined in the code. Herein lies the key. Without the continuing support of the division's management, the program would not survive.

If you look about you, you will probably see many employees who represent minority groups. This doesn't mean, however, that no problem has existed in the area of equal opportunity employment.

Cannot Relax Effort

It also doesn't mean we can relax and forget the whole matter. For example, we have introduced sessions on equal opportunity employment into our regular management and supervisory training program, so that when new people assume responsibilities for hiring practices and policy enforcement, they will receive a basic understanding of the subject.

The question posed to the division and, for that matter, to society as a whole, is not "Are we doing a good job?" but "What else can we do?"

Where do we go from here and what success can we expect? These questions will only be answered by time, but we look forward to the success anticipated by Mr. Womack when he stated, "It is our hope that equal opportunity courses will promote better understanding among all our employees and that our employee relations in this important area will be even better than they have in the past."

Division Issues New Bridge Design Manual

A revised edition of its *Manual of Bridge Design Practice* has been issued by the Bridge Department of the California Division of Highways.

The revised edition is similar to the 1960 one but is updated to the American Association of State Highway Officials 1961 Design Specifications and the 1963 Interim Specifications.

The section on "Rolled Beam Bridges" has been replaced with one on "Structures Under Roadway Embankments." A new section on tunnels has been added.

Each section follows through the detailed design of its type of structure.

The 8½-by-11-inch clothbound manual has 644 pages of design theory, examples, illustrations and charts and tables.

The publication is available from the Office of Procurement, Documents Section, P.O. Box 1612, Sacramento, California 95807.

The price including postage is $12.50 plus 4 percent sales tax in California and $13.50 outside the United States. Remittance should accompany an order.

ITTE Conference

Legislation and SB 344 Highlight UCLA Sessions

Widespread interest in current proposed legislation was displayed by the majority of persons who attended the 17th Annual Streets and Highways Conference, sponsored by the Institute of Transportation and Traffic Engineering, at the University of California, Los Angeles, January 27–29.

The Thursday morning audience of approximately 550 conferees heard reports from Senator Randolph Collier, Chairman of the Senate Committee on Transportation, and Assemblyman Tom Carrell, Chairman of the Assembly Committee on Commerce and Transportation.

Collier's remarks outlined legislative proposals he intends to sponsor in 1965.

His first is the addition of one cent to the state gasoline tax on a temporary basis to accomplish the dual objective of taking care of emergency needs to highways and bridges damaged in recent floods while still permitting highway construction projects to go forward on schedule.

Among major participants at the conference were (left to right) George Longsner, Deputy State Highway Engineer and general chairman; Harmer E. Davis, Director of the Institute of Transportation and Traffic Engineering; State Senator Randolph Collier, Chairman of the Senate Committee on Transportation; and Assemblyman Tom Carrell, Chairman of the Assembly Committee on Commerce and Transportation.

Clarification Require

The Senator advised that certain aspects of the Collier-Unruh Local Transportation Development Act (Senate Bill 344) require clarification and said he will introduce legislation to make changes that "will assure administrative efficiency and less red tape."

He cited three legislative plans that would have a direct bearing on freeway procedures. The first would provide relocation expenses to families and businesses when properties are acquired by a state agency; the second would place independent hearing officers in charge of freeway route adoption hearings; and the third would call for a study to guide the Governor in making appointments to the Highway Commission in order that a broad spread of professional experience will be represented.

Other legislation would require all road commissioners appointed after December 31, 1965, to be registered engineers and safeguard them from dismissal.

Collier then declared that the fact that only comparatively minor changes in the California freeway and expressway system have been recommended to the Legislature this year by the Division of Highways is a tribute to the original design.

"But," he pointed out, "as always, they will be controversial in individual situations, especially where a deletion of mileage is concerned.

"And we can be assured that in a state as dynamic and changing as California, a rather major overhaul of the system will be due the next time around. Fortunately, by that time we will have results available from the comprehensive transportation studies now under way in our larger urban areas.

"We should also know the nature of the federal interstate program that will continue after 1972. And we will have the results of the transportation study of the aerospace industry has been invited to undertake.

"All in all, once these things have been accomplished, future Legislatures will have a much superior factual and analytical background upon which to base its decisions than we have had in the past."

Interim Studies Cited

Assemblyman Carrell lent further insight to legislative proceedings. He cited interim studies by the Assembly Committee on Commerce and Transportation, and correlated them to new legislation required because "providing road space for a mushrooming automotive population is one of the most vexing problems of our time."

Carrell declared that it is his opinion that the legislative task in the general field of highway transportation is a never-ending one because new legislation is constantly required to cope with a dynamic highway system that continues to develop in size and com-

plexity so that it in turn can keep pace with the ever-increasing number of vehicles utilizing it.

The rapid transit system proposed for the Los Angeles area should alleviate some traffic congestion in that area, according to Carrell. But he removed it from the "cure-all" category with the statement: "I am afraid, however, that by the time the transit system comes into being, the growth of population, coupled with a never-ending demand for motor vehicles, will leave us pretty much where we are today."

While describing testimony heard by his committee, Carrell said that "the committee's findings indicated that the Department of Public Works and the Division of Highways have done exactly what the law says they should do.

"They are charged with the responsibility to provide means to get from one place to another with a minimum of travel distance and at a minimum cost. This they have done."

Route Adoption Problems

In his discussion of problems involved in route adoptions, Carrell declared it inevitable that there should be an outcry from those who would have them go somewhere else and he said this discontent is reflected in recently suggested sweeping changes. "But," he added, "I say instead that a constructive approach to any problem that may exist is preferred to a sweeping abolition of an existing entity . . . and am confident that the Legislature will not be persuaded to throw the baby out with the bath water."

Other topics discussed during the conference ranged from electronic data processing in San Diego to reduced visibility studies in northern California, but two which had particularly broad appeal dealt with vehicles of the future and the highway complexes they will require and an evaluation of the effectiveness of the Collier-Unruh Act.

Vehicles of the future were discussed at a Saturday luncheon meeting by Wilbur Smith, President of Wilbur Smith and Associates.

Smith predicted that the foreseeable future will not be marked by radical changes in either automobiles or highways. He was skeptical of the development of any radically different engine and pointed out that known petroleum reserves will be only 10 percent depreciated by the year 2000.

He does anticipate more types of vehicles with the expansion of leisure time for the individual and his family. Smith used the development of the camper as an example and believes more vehicles designed to provide a service equally specific will reach the market.

Evolution of Auto Traced

Smith traced the evolution of the automobile through various areas. The time prior to 1920 was used in perfecting a vehicle of sufficient mechanical reliability that "it could be trusted to go down the road."

The next 20 years (1920–1940) were marked by the inclusion of safety and comfort factors.

From 1940 until 1960, Smith explained, was the engineering era in which automatic transmissions, power steering and like devices were added.

1960 marked the beginning of the present era which he identified as the "systems approach" and it is personified by the stress directed toward making the relationship between the vehicle and the complex of highways, roads and streets upon which it travels more and more compatible. It is in this present era that the automobile power plants will double in efficiency, Smith believes, but he is equally certain the gain will be tapped off to operate additional accessories.

Senate Bill 344 was the Friday morning theme. It provides for financial assistance from the state to cities and counties in the construction of certain "select" streets and roads. Funds are derived from the state gasoline tax and must be expended exclusively for construction and rights-of-way in accordance with specific criteria.

David K. Speer, San Diego County Road Commissioner, observed "there have been as many suggestions for revision and criticism of portions of the act as there are cities and counties in the State of California."

But in retrospect, Speer believes the act has been successful and that the constructive results to the motoring public are emerging to where they can be seen.

Collier-Unruh Act History

The legislative history of the Collier-Unruh Act was traced by Richard Carpenter, executive director and general counsel of the League of California Cities.

He explained that many administrative problems had been faced by the local agencies during development of the procedural policies, but that fortunately through the corrective efforts of committee representing the "league," the supervisors' association and the state, many of the "procedures" had been modified and are now more workable.

Charles T. Ledden, city and county projects engineer for the California Division of Highways, outlined basic tenets that govern the California Highway Commission and the Division of Highways in allocating the funds and administering the program.

According to Ledden, the more important problems raised were ones not difficult to solve once properly defined. Among them were the tasks of identifying "eligible work" and "eligible matching funds," minimizing red tape, and justifying the state's demand that construction be of such design that it is capable of meeting (or being later adapted to meet) traffic needs of 20 years from now.

Other Speakers

Other speakers at the general sessions included Harmer E. Davis, director, Institute of Transportation and Traffic Engineering, who outlined some of the conference's aims; Newton H. Templin, road commissioner, Los Angeles County, who spoke on the Collier-Unruh Act; Myron Tatarian, director of public works, County and City of San Francisco; and Sheridan E. Farin, regional engineer, Region 7, U.S. Bureau of Public Roads, who discussed future federal planning.

Also Slade Hulbert, associate research psychologist; Albert Burg, assistant research psychologist; Edward Levonian, associate research psychologist; and Harry W. Case, assistant director (all ITTE staff members). These individuals formed a panel and discussed human factors in traffic safety.

General meetings were conducted each morning and delegates attended

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State Parks Chief Clarifies National Tribute Grove Status on Route 199

March 15, 1965

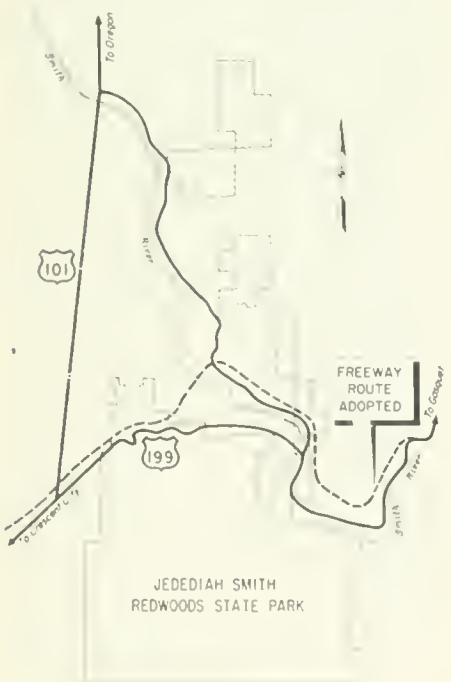
Mr. Sam Helwer
District Engineer
Division of Highways
430 West Wabash Avenue
Eureka, California

Dear Mr. Helwer:

This letter is for your information and to set the record straight regarding the physical relationship of Jedediah Smith Redwoods State Parks' National Tribute Grove and the adopted freeway route through that portion of Del Norte County.

As you know, Highway 199 now traverses nearly two miles of the northwest corner of Jedediah Smith Redwoods State Park. As you also know, the adopted freeway route through this area avoids all but some 5,000 feet of a protruding tip of park land that has been the center of some unfortunate misunderstanding.

It is now agreed that, under the terms of a resolution adopted 20 years ago by the State Park Commission, this narrow neck of park land, presently crossed by Highway 199 and to be crossed by the freeway, is technically a part of the National Tribute Grove.



Acreage records kept by the Save-the-Redwoods League, which recommended the February 1945 resolution of the State Park Commission, had led my staff to advise me that the adopted freeway route would pass one-third of a mile or more from the nearest corner of the National Tribute Grove. I, in turn, so advised you.

The State Park Commission resolution in 1945 described the National Tribute Grove as "the redwood forest lands in the (then) Mill Creek Redwoods State Park, Del Norte County, not yet bearing names as memorial groves, " plus "that redwood forest land added to this state park under terms of the purchase option now in effect."

Thus, according to the resolution which created it, the National Tribute Grove is not a grove at all, but a large area of redwood park lands covering many widely scattered groves in a number of drainages. It even includes several disconnected parcels as far as five miles outside the main body of the park.

The statutes clearly show that the State Legislature has not considered all of this land to be held as the National Tribute Grove. In 1951 the Legislature authorized the exchange of some parcels that were technically part of the Tribute Grove, stating that "the limitation for use for park purposes shall not apply."

In 1963 the Legislature authorized the sale of some lands included in the original description of the National Tribute Grove, noting that they had been "acquired for exchange purposes."

A study of the literature of the Save-the-Redwoods League shows that its primary purpose in sponsoring the National Tribute Grove was to protect what the League described as the "giant trees on Mill Creek in Del Norte County, by many considered the finest of all the redwood groves."

EDITOR'S NOTE

In the third article of the Redwood Highway series, which was published in the September–October 1964 issue of this magazine, the statement was made that the adopted route for the relocation of Highway 199 in Del Norte County passed to the north of the north limit of the National Tribute Grove in Jedediah Smith State Park. This statement was subsequently challenged by representatives of the Sierra Club before a legislative committee.

The statement as published was excerpted from a letter written to District Engineer Sam Helwer at Eureka by Charles A. DeTurk, Chief of the State Division of Beaches and Parks, under date of September 17, 1964.

In the accompanying letter dated March 15, 1965, Mr. DeTurk gives the background of the National Tribute Grove designation and explains that the adopted freeway routing of Highway 199 does cross a narrow neck of park land which is technically a part of the grove.

As you know, the narrow tongue of outlying park land to be crossed by the improved highway is completely outside the Mill Creek drainage, which we firmly insist must be kept inviolate for all time.

In adopting the National Tribute Grove resolution 20 years ago, encompassing nearly all of the main area of Jedediah Smith Redwoods State Park and even some lands miles away from it, the State Park Commission had no way of knowing that the resolution would not work perfectly for all time in the best total interests of the public and the park.

There can be no question that, for the safety of the driving public on this main artery of through traffic, heavily used by huge trucks and buses and crowded with tourist traffic in summer, Highway 199 must be realigned and brought up to safe highway standards.

Most fortunately, the Division of Highways is cooperating fully with the Division of Beaches and Parks to

. . . Continued on page 59

Mount Shasta

New Section of Interstate 5 Traverses Spectacular Area

By CHARLES MOSS, Resident Engineer

On October 17, 1964, State Senator Randolph Collier officiated at the dedication of another 6.8 miles of Interstate 5 four-lane freeway from 4.6 miles south to 1.5 miles north of Mount Shasta city limits. With the completion of this section, there are approximately 37 miles of continuous four-lane expressway and freeway from the upper limits of Shasta Lake to Mount Shasta.

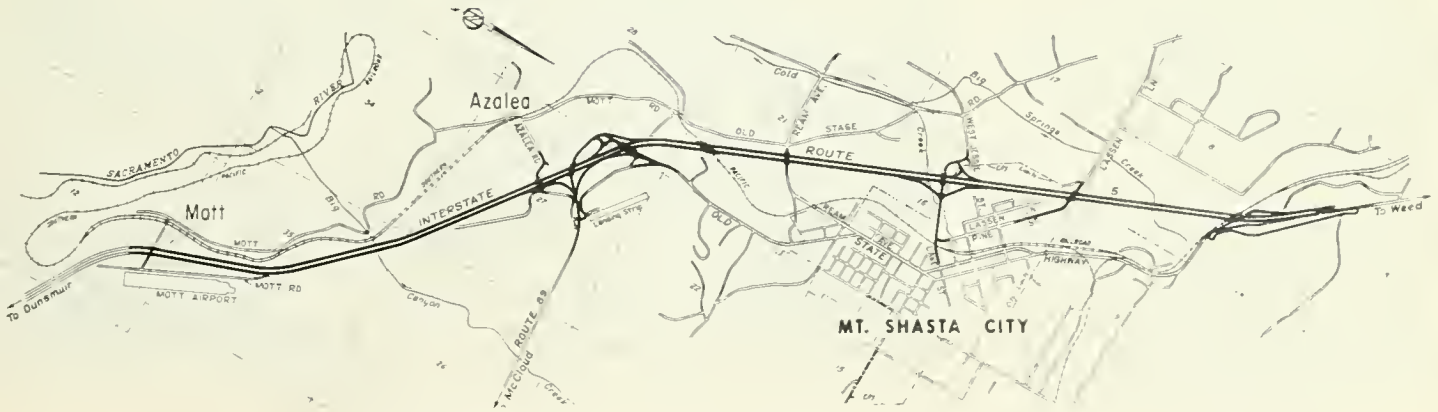
This section of freeway exhibits some of the most beautiful scenery found in California and passes along the west slope of majestic, snow-covered Mount Shasta.

The area is both a winter and a summer playground. The ski lifts on the snow-covered slopes of Mount Shasta attract 80,000 persons each season. It is also recognized as a hunting, fishing, and camping area. The proposed Box Canyon Dam, about two miles southwest of the city of Mount Shasta, is expected to attract many more summer vacationers to the area.

Old Road

In general, the old highway consisted of two 10-foot bituminous-

The completed section of I-5 freeway looking south near Mount Shasta City.



A map showing the location of the new freeway section through the Mount Shasta City area.

Looking toward Mount Shasta from above the completed freeway south of Mount Shasta City.

paved traveled lanes on a 23-foot roadbed with widening only in the major business area of the City of Mount Shasta. Most of the original alignment was on a route constructed in 1922 and 1923.

The portion through the rough terrain south of Mount Shasta was very crooked and had many curves of less than 500-foot radius. This old route offered very limited opportunities for passing slow-moving trucks on the steep grade. During heavy traffic flow, it was quite common to have as many as 50 cars and trucks delayed by a slow-moving vehicle for a distance of three to four miles.

During the winter months when snow and ice conditions prevail, sharp curves combined with steep grades would often cause trucks to block the roadway.

New Roadway

The minimum curve radius on the freeway is 3,000 feet and the maximum grade is 4 percent.

The typical section has a 60-foot median, two 12-foot lanes of 8 inches of portland cement concrete in each direction, with 10-foot asphaltic concrete shoulders on the right of traffic.

An aerial of the completed freeway looking northwest toward Black Butte Mountain. Structures are Lake Street overcrossing (foreground), Lassen Lane overcrossing (center) and North Mount Shasta railroad underpass in the distance.

Additional lanes can be constructed in the median for an ultimate six-lane section.

Full interchanges were constructed at the junction of State Route 89 and at the Lake Street intersection, with partial interchanges connecting the freeway to old Route 99 on each side of the City of Mount Shasta. Overcrossings to accommodate local traffic were built at Azalea Road, Ream Avenue, and Lassen Lane.

A total of 850,000 cubic yards of roadway excavation was removed by contour grading the combined system of ramps composing the Route 89/5 separation and the south Mount Shasta interchange. This excavation was used for the 660,000-cubic-yard embankment at Pioneer railroad overhead.

The project required two crossings of the Southern Pacific Company railroad tracks. The Pioneer overhead crossing consists of twin reinforced concrete box girder bridges, 241 feet long, each with deck measurement of 39 feet between curbs.

The north Mount Shasta crossing consists of a riveted steel plate girder railroad bridge underpass which was constructed under a prior contract and completed during the early stages of this contract.

Unusual Conditions

Between the Pioneer railroad overhead crossing and Lassen Lane overcrossing the line traverses an area of marshy, peat, meadowland with numerous artesian springs which are fed from melting snow on Mount Shasta.

The roadway section in this area consists largely of shallow fills. The original ground was excavated to a depth of five feet below finished grade and to a width of three feet beyond shoulders. This mud and peat was replaced with a very porous material excavated from the roadway approximately two miles to the north. To drain and stabilize the foundation, 21,300 feet of perforated pipe was placed and intereception trenches, four to eight feet deep, were excavated on each side of the roadway.

The water table in this area is seldom more than two feet below ground. Several artesian springs were covered during embankment construction. The water forced its way up through the shallow embankment to heights of 12 feet above the bottom of adjacent interception trenches. Later, each spring was opened and drained with an additional perforated drainage system.

Extreme care was necessary in the placing of a 60-inch reinforced concrete pipe and construction of the embankment at Big Springs Creek, to prevent silt from entering the stream. This stream, the headwaters of the Sacramento River, is also the water supply of the Mount Shasta State Fish Hatchery, one of California's oldest trout hatcheries. The hatchery reported that it processed 17,000,000 trout and salmon eggs during the time this project was under construction without loss attributable to the highway construction.

In placing the portland cement concrete pavement on this project, the contractor used a central mix plant and hauled the mixed concrete in dump trucks to a slipform paver.

In his efforts to complete construction before onset of winter, the contractor adopted an around-the-clock concrete paving operation. Elimination of construction joints and carryover of finishers coupled with the increased efficiency of a continuous operation were economic advantages of this paving procedure.

This project was constructed by Fredrickson and Watson Construction Company at a cost of $4,800,000. The work was done over a period of 22 months and was completed in December 1964.

Indexes Available For Old Issues

Long-time readers of *California Highways and Public Works* whose files of the magazine antedate 1937 may now obtain copies of a specially printed index to these early issues. A limited reserve supply of this index, covering the issues through December 1936, has been declared surplus and will be sent to interested readers on a first-come first-served basis while the supply lasts.

Requests should be addressed to the editor.

ITTE Conference

. . . Continued from page 55

workshops on Thursday and Friday afternoons.

George Langsner, Deputy State Highway Engineer, was general chairman of the conference. Tatarian and Templin were vice chairmen. Robert E. Cron, Jr., ITTF, was general secretary, and Wayne H. Snowden, ITTF, was in charge of publications.

State Parks

. . . Continued from page 56

not only protect Jedediah Smith Redwoods State Park in every way possible, but to so locate the new highway that it will provide for an even better park.

The present Highway 199 traverses the floor of the Smith River valley through prime redwood forest lands we hope to add to the park. Through the cooperation of the Division of Highways, the new freeway route has been moved to the other side of the Smith River, away from the park, leaving undisturbed the redwood forest we hope to acquire for future park use.

Considering the total package of park values, I am convinced that the basic highway route adopted through the general area of Jedediah Smith Redwoods State Park is the best of the feasible routes that man can devise. Furthermore, I am confident that any possible refinements of this basic route will be worked out by the state agencies concerned to gain the utmost in park and highway benefits.

Sincerely,

CHARLES A. DETURK
Chief

EEL RIVER BRIDGE REPLACED

The State Department of Public Works has awarded a $2,020,000 contract for constructing a bridge across the Eel River on US 101 2½ miles south of Scotia, Humboldt County.

The former bridge was destroyed during the Christmas floods.

The State Department of Public Works has awarded a $1,444,000 contract for widening Interstate 80 (Elvas) Freeway from four to six lanes between A Street in Sacramento and just north of Arden Way.

Experimental Paint Results

By H. A. ROONEY, Senior Chemical Testing Engineer, and
A. L. WOODS, Bridge Painting Inspector

The January February 1962 issue of *California Highways and Public Works* carried an article describing protective coatings applied to Leffingwell Creek Bridge under a continuing experimental program by the Materials and Research Department and the Bridge Department of the Division of Highways. The report was based on observation of the paint condition in May 1961, about 2½ years after applications were made in 1958.

The Leffingwell Creek Bridge, on Route 1 just north of Cambria, in San Luis Obispo County, was chosen for this series of tests because the incidence of corrosion at the bridge site is the worst encountered in the entire state highway system. This bridge and several others similarly situated close to the ocean present an ideal location where protective coatings may be tested in very corrosive environment of moisture and salt-laden winds. The severity of the corrosion problem is indicated by the painting history of the bridge. Built in 1932, it required eight paint jobs up to 1958. This amounts to an average of one paint job every 3¼ years, and the maximum service life obtained from any one of the eight jobs was 6 years. Figure No. 3 shows what happened when the paint job was allowed to stand for 6 years.

Strong Indication

The May 1961 report made no definitive evaluation of the various systems because the exposure period was too short to permit accurate appraisal. However, there was strong indication of what was to follow. Now,

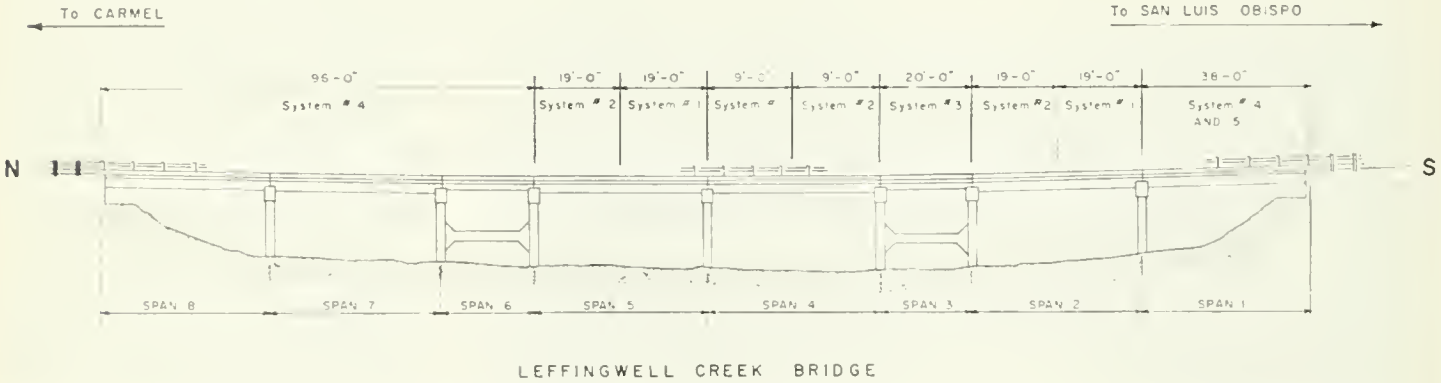


FIGURE 1—A diagram of the Leffingwell Creek Bridge on Route 1 in San Luis Obispo County showing the location on the structure of the various types of paint which were studied.

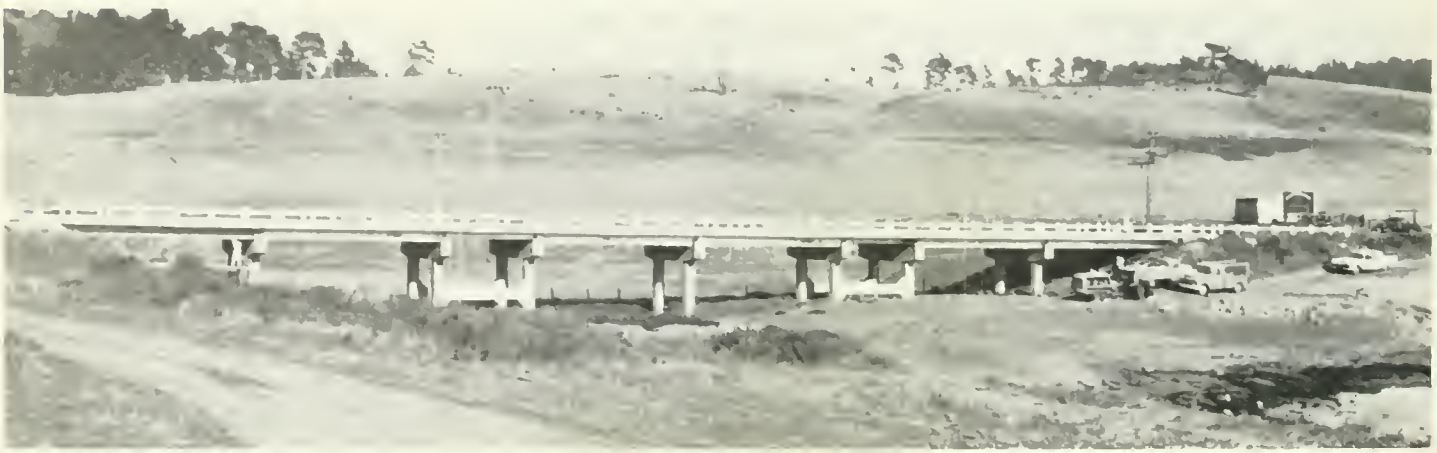


FIGURE 2—A photo of the actual bridge shown in the diagram above.

FIGURE 3—Condition of average paint system applied in 1952 after six years' service.

after nearly 6 years of service, a conservatively reasonable projection of service life expected from each system can be made.

Rating of the systems and conclusions reached follow:

1964 ANNUAL REPORT ON EXPERIMENTAL WORK

Leffingwell Creek Bridge, No. 49-44
Painted October 1958
Inspection Date February 20, 1964

Ratings are made on an inverse scale of 10 to 0. A rating of 10 would indicate no rust, and lesser ratings indicate more rust.

Span 1—System No. 4, total 6 mils.
Ends of several bracing members showing tubercules. Some rust around bearings. A few spots on bottom of bottom flange and on bottom flange edges. Top flange edge rust growing slowly.
Rating: 8.

Span 1—Four mils red lead primer, State Specification 58-G-53, and two mils of State Specification 58-G-79 green topcoat. More rust than on vinyls in adjacent areas.
Rating: 7.

Span 2—System No. 1, total 6 mils.
Good shape. Rust or rust stain along top edge of top flange does not appear to be growing much. Bracing good. Light rust on steel slivers has not penetrated steel proper.
Rating: 9+.

Span 2—System No. 2, total 8 mils.
Considerable rust throughout on webs. Worst area on webs near pier.
Rating: 6.5.

Span 3—Inorganic zinc silicate—laboratory production. Application too recent to rate properly (1962).

Span 4—System No. 2, total 8 mils.
Freckle rust throughout. This system shows no promise for coastal exposures. Despite additional thickness more rust has occurred. Will discard this one.
Rating: 6.

Span 4—System No. 1, total 6 mils.
Only rust is on abrasions and laminations. Excellent shape.
Rating: 9+.

Span 5—System No. 1, total 6 mils.
Condition similar to Span 4, System No. 1. Very good.
Rating: 9+.

Span 5—System No. 2, total 8 mils.
Better shape than same system in other spans. Some rust on bottom and top flanges and on flange edges.
Rating: 7.5.

Spans 6, 7, 8—System No. 4, total 6 mils.
Very good shape for 6 years' exposure. Light rust scattered throughout mainly on flange edges, bracing member edges and ends and around bearings.
Rating: 8.

Conclusions

All systems are performing better than expected in such a highly corrosive area.

FIGURE 4—Condition of paint system No. 4 applied in 1958 after six years' service. This is the same area as shown in Figure 3. The condition in Figure 4 is typical of system No. 4.

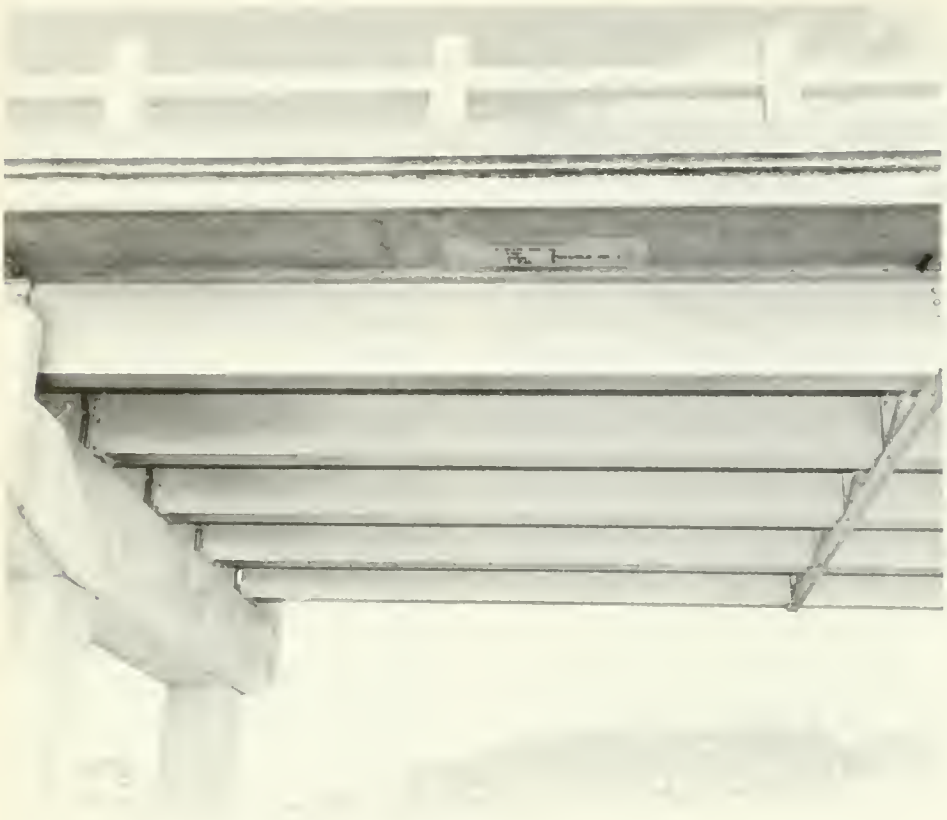


FIGURE 5—Typical condition of point of system No. 1.

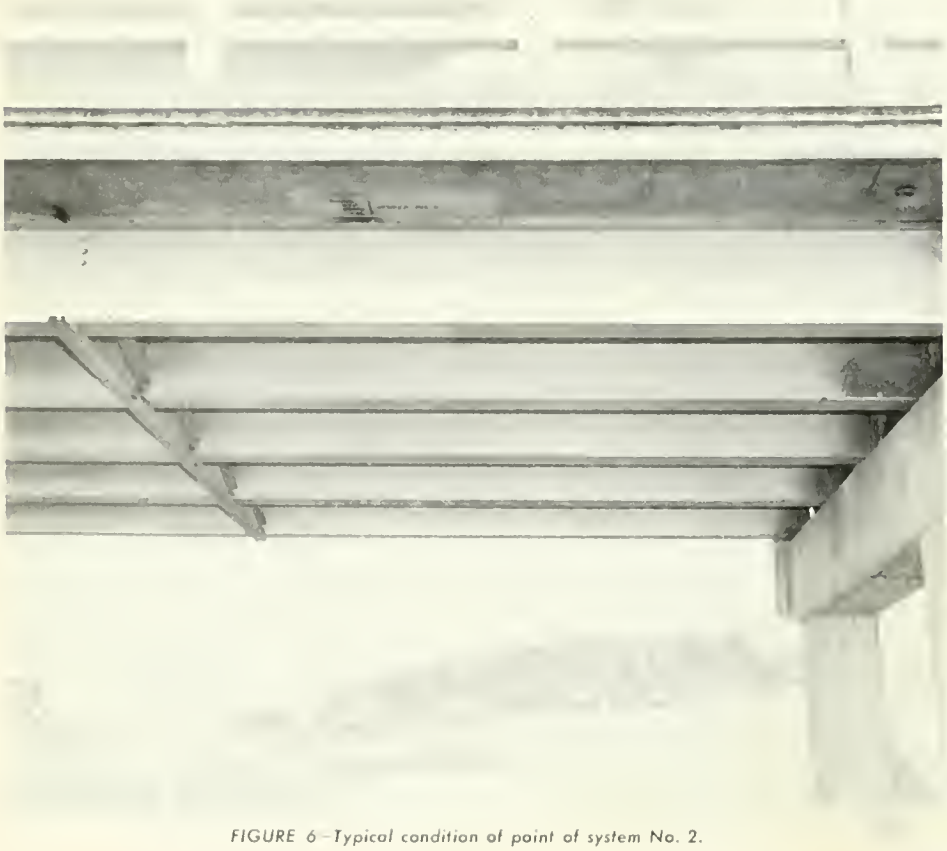


FIGURE 6—Typical condition of point of system No. 2.

System No. 1 performance is currently the best. The relative absence of breakdown makes it impossible to accurately estimate how long this system will last since there is no way to determine how much zinc has been lost through corrosion processes. A conservative guess is six years longer, or a total of 12 years servicelife.

System No. 4 rates second best, and repainting will probably not be necessary for another four to five years or longer. Servicelife will then be 10 years or longer.

More rust exists in areas covered by System No. 2, but it now appears that no replacement of paint in those areas will be necessary for about two or three more years. It could possibly last longer. This will give a minimum servicelife of eight years or more.

Rust Condition Not Typical

The rust condition along the top flange edges which was discussed at length in previous reports is more or less ignored in this report since it is not typical of that normally encountered. However, it is worth noting that less rust on these edges is found in areas covered by System No. 1. This is probably traceable to galvanic protection afforded by the zinc which tends to inhibit rust penetration or undercutting of sound paint by spreading rust. Results of accelerated tests on scribed sections in laboratory salt-spray cabinets confirm field findings in this respect.

Similar results are found in field applications of zinc-rich coatings in both organic and inorganic vehicles, although they are less pronounced with the organic. A more extensive use of inorganic zinc silicate coatings on our coastal bridges seems to be economically justified. It appears that increased servicelife more than offsets the slight increase in total costs.

TABLE I

COATINGS

System No. 1

3 mills of inorganic zinc pigment-silicate binder cured with a phosphoric acid solution, curing agent scrubbed off with water, vinyl wash primer, State Specification 52-G-52, applied followed by 2 mils of vinyls, State Specifications T58-G-40 and T58-G-41

. . . Continued on page page 66

Highway 395

Construction Continues on Important South State Route

By F. A. THUDIUM, Project Engineer—Design

The California freeway-expressway system, totaling 12,414 miles of road, was signed into law by Governor Brown on June 19, 1959. The 102 mile portion of US 395 linking Riverside and San Bernadino to San Diego is one of the important segments of road included in this system.

In addition to the three major metropolitan areas of Riverside, San Bernardino and San Diego, two new areas have started developing along this route. The Rancho California is now in the planning stage. A population concentration of 400,000 people is envisioned for this 87,500-acre development located south of Perris near the Riverside and San Diego county line.

About 20 miles south of the proposed Rancho California development and 30 miles north of San Diego, we have the Escondido and the North San Diego City area rapidly developing. Escondido is a long established city, but within the last ten years it has been one of the fastest growing areas in San Diego County.

City Limits Extended

Early in 1962 the San Diego city limits were extended approximately 10 miles to the north to include the proposed communities of Rancho Bernardo and Rancho Los Penasquitos. The proposed $300,000,000 Rancho Bernardo Community has an expected population of 50,000 on about 5,000 acres by 1975. The 14,000 acre Los Penasquitos Community is expected to develop a population of about 150,000 in 20 years. Both communities will contain the basic elements of industrial, commercial, recreational and residential areas.

In 1961 it was estimated that the two-lane highway section between

Highway 395 is an important north-south artery in and north of the San Diego area.

San Diego and Escondido was carrying approximately three times the traffic for which it was designed. US 395 was not designed for heavy truck traffic, and the increase of commercial use between San Diego and San Bernardino on the very steep and lengthy grades adds to the congestion.

Construction of the 16-mile section of US 395 between Pomerado-Miramar Road and Escondido was divided into four units. Each unit has an initial four-lane construction of an ultimate eight-lane development with separated roadways and a variable width median.

Design standards established for major freeway routes were used on these projects. The 2,000-foot minimum radius curves and 6 percent maximum grades on the existing highway have been improved to 4,000-foot minimum radius curves and approximately 3 percent maximum grades.

The first unit between 1.7 miles north of Pomerado-Miramar Road and 1.4 miles north of Poway Road will be completed in May 1965 at a cost of $3,400,000. O. K. Mittry and Sons handled this 3.6-mile section.

The second unit between Pomerado-Miramar Road and the Poway Road construction has an expected completion date of December 1965, at a cost of $2,000,000. Daley Corporation is handling this 3.2-mile section which was awarded January 21, 1965.

Poway Road Unit

The third unit, a 5.2-mile section north of the Poway Road construction, is expected to be under contract this summer. This section, estimated at $3,600,000 will complete the freeway through Rancho Los Penasquitos and into Rancho Bernardo to the Rancho Bernardo Road Interchange.

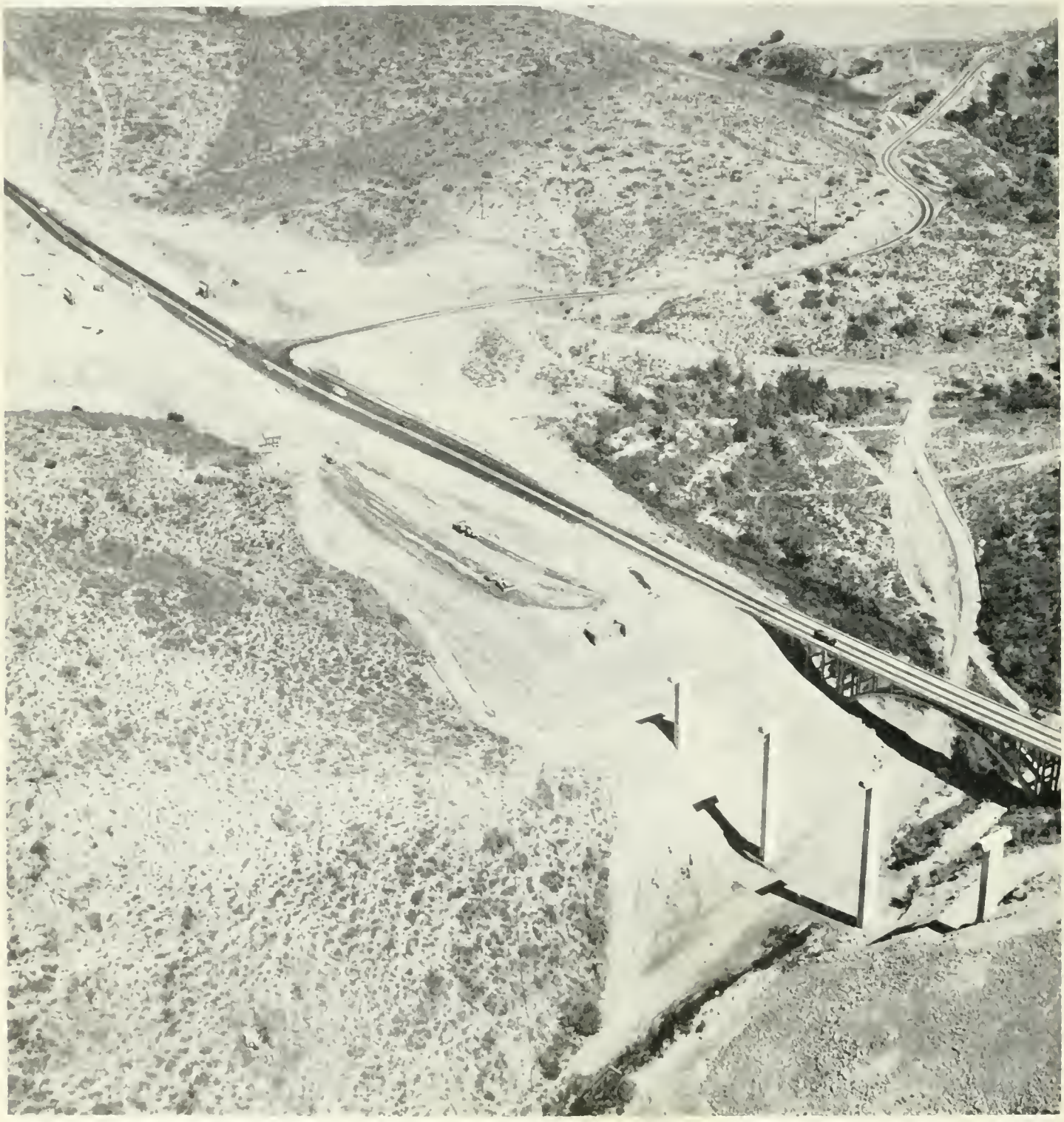
The fourth unit, planned for construction beginning in early 1966, if funds are available, will complete the four-lane freeway between Pomerado-Miramar Road and the four-lane expressway through the City of Escondido. This 4.4-mile section, estimated to cost $3,500,000 will have a southbound map stop just inside the northern city limits of San Diego in the Rancho Bernardo area.

Construction of Unit I involved 2,500,000 cubic yards of excavation of shattered and massive blocks of volcanic rock in the 200 foot "Big Cut" on the south end of the project. The shattered rock combined with a thin

clay layer resulted in a slide in the easterly face of the "Big Cut." This slide of approximately 100,000 cubic yards occurred in three phases. Phase one lasted about six hours and contained the majority of dirt. Phase two was a minor continuation of phase one. The third and last phase was of a larger magnitude and lasted approximately two days. After several weeks, the material was removed and the cut slope was laid back to the slope of an underlying bedding plane of approximately 1½:1.

Two New Bridges

Two bridges of this unit will now carry traffic over Los Penasquitos Creek just south of the Poway Interchange. The new prestressed composite girder bridge to be used for southbound traffic is approximately 135 feet



Looking northeast up Penasquitos Creek from above the present bridge and the piers of the new bridge. Powoy Road is in the background.

above the creek bed and 65 feet above the existing concrete arch bridge constructed in 1949. The four piers of the new bridge were constructed by the use of slipforms and continuous concrete pours. A series of jacks and sightings on the centerlines of the end and side of each pier assured true vertical alignment.

Two construction projects in the City of Escondido are converting the existing two-lane conventional highway into an expressway. The first of these projects is now completed and extends the existing Escondido expressway south where it is to be joined ultimately by the earlier mentioned freeway.

The second project, which is in the grading stage of construction, will extend the existing expressway northerly to the point where it will join the future bypass freeway.

The Escondido Bypass will replace the existing expressway through town. Freeway agreements have been concluded with the City of Escondido and the County of San Diego in their respective areas.

Design Work Started

Design of the six-lane freeway has begun on this 10.6-mile section. The relocation will leave the existing route approximately 1½ miles north of Lake Hodges and will rejoin US 395 approximately three miles north of Route 78. This realignment bypasses the business and older residential areas to go through a sparsely settled area of avocado groves approximately one mile west of existing US 395.

The 20-mile section of US 395 north of Escondido to the county line is now in the planning stage. This section is possibly the key to the extent of ultimate use of this route, particularly by commercial traffic. This 20 miles through extremely rough and rocky terrain, crosses two main canyon areas of low elevation which necessitated the heavy 6- to 7-percent grades of extreme length, characteristic of the existing road. The northerly nine miles of this section is on the scenic highway system.

This rugged section is the potential bottleneck in this hundred miles of highway. The gradient and alignment problem has been solved from San Di-

Looking north into Penasquitos Canyon showing the present two-lane highway with 6-percent grade. Poway Road is in the background.

Looking northwest down a 7-percent grade section of present Highway 395 toward the San Luis Rey River. This is typical of the existing route north of Escondido.

ego through Escondido. After crossing the county line the terrain to the north is relatively flat and the existing highway has minimum gradient and good alignment.

Development of the north San Diego County area will be influenced by the solution of the location and design of this important segment of US 395.

EXPERIMENTAL PAINT

Continued from page 62 . . .

in alternating coats and a final coat of 1 mil of State Specification T58-G-49, vinyl paint, aluminum finish coat.

Total film thickness, 6 mils.

System No. 2

Vinyl wash primer, State Specification 52-G-52; 2 mils of semi-quick drying red lead primer, State Specification 58-G-53; 2 mils of white traffic paint, State Specification 55-G-95; 2 mils of vinyl paints, State Specification T58-G-40 and T58-G-41 in alternating coats; 1 mil of State Specification T58-G-49, vinyl paint, aluminum finish coat.

Total film thickness, 8 mils.

System No. 3 *

Epoxy paint, 100 percent solids, made with an epoxy resin of viscosity 40–100 poise at 25° C and an epoxide equivalent of 180–195, 20 percent TiO_2 and 5 percent Cr_2O_3 cured with an epoxy amine adduct and applied by hot spray 15–20 mils thick.

System No. 4

Vinyl wash primer, State Specification 52-G-52; 4 mils of vinyl paints, State Specifications T58-G-40 and T58-G-41 in alternating coats; 2 mils of vinyl paint, aluminum finish coat, State Specification T58-G-49.

Total film thickness, 6 mils.

System No. 5

Vinyl wash primer, State Specification 52-G-52; 4 mils of semi-quick drying red lead primer, State Specification 58-G-53; 2 mils of phenolic iridescent green, State Specification 58-G-79.

Total film thickness, 6 mils.

INTERSTATE 5 EXTENDED

The State Department of Public Works has awarded a $2,990,000 contract for completing the four-lane Interstate 5 freeway between the Sacramento River north of Anderson and two miles north of Redding, Shasta County.

The project will extend freeway construction now in progress through Anderson another 12 miles northward.

* System No. 3 failed early and was replaced in 1962 with a laboratory formulation of inorganic zinc silicate.

The east face of the "Big Cut" an Unit 1 construction showing the 100,000-cubic-yard slide after the third and final phase.

A continuous concrete pour on the new Penasquitos Creek Bridge with slipforms. Existing two-lane arch bridge is in the background.

WHITEHURST, GUTHRIE REAPPOINTED TO COMMISSION

WILLIAM S. WHITEHURST

JAMES A. GUTHRIE

Governor Edmund G. Brown has announced the reappointment of William S. Whitehurst, Fresno businessman, and James A. Guthrie, retired editor of the San Bernardino *Daily Sun and Telegram*, to the California Highway Commission for a term of four years.

In making the announcement, the Governor praised both men's contributions to the board, and said, "We are fortunate in having the services of two men devoted to guiding the state's growth while maintaining its beauty. Bill Whitehurst has met the demands of commission work with unbiased, forward-looking judgment. He is a conservationist and businessman, and so serves the best interests of the people of California.

"Jim Guthrie has been a pioneer in highway development through three administrations, and has played an integral part in shaping our transportation system.

"I feel we need their help in planning for the growth of the future."

Whitehurst, a licensed mortician, has interests in funeral chapels in Los Banos, Dos Palos, Firebaugh, and Fresno; he is active in real estate and ranching in the Fresno area, and was formerly a city councilman in Los Banos and Dos Palos. He is a member of the Fresno Art Center, the Fresno Sportsmen's Association, the Foresters, the Farm Bureau Federation, the Knights of Columbus, the American Legion, the Veterans of Foreign Wars, the Commonwealth Club, and St. Mary's College Alumni. He was first appointed to the Highway Commission in 1963.

James Guthrie was born in San Bernardino in 1888 and has been a resident there since, working for community and highway improvement as an individual and as editor of the San Bernardino *Daily Sun and Telegram*, of which he is editor emeritus. He served as president of the local chamber of commerce and is a member of its state board of directors. He is a member of the advisory board of the Automobile Club of Southern California, the California Club, and the Sutter Club.

Guthrie was appointed to the Highway Commission by former Governor Earl Warren in 1943 and has served continuously since then.

WASHO Conference Set for Santa Fe

The 44th Annual Conference of the Western Association of State Highway Officials is scheduled for Santa Fe, New Mexico, during the week beginning Monday, June 14, 1965.

C. Taylor Burton, administrative consultant to the Utah Road Commission, is president of the 14-state organization, which held its 1964 meeting in San Diego. Other officers are Charles E. Shumate, Colorado State Highway Engineer, vice president, and George Langsner, California Deputy State Highway Engineer, secretary-treasurer.

General chairman for the 1965 conference is Robert W. De La Rue, administrative engineer for the New Mexico State Highway Department.

IN MEMORIAM

District III

Otto E. Claussen, highway maintenance man III.

Kenneth L. Horgan, highway maintenance man III.

Charles E. Russell, highway engineering technician I.

District IV

Marion P. Cunningham, senior stenographer.

District VII

Vera L. Katzung, delineator.

Ben Kutukian, engineering aid II.

District X

Jethro Cravens, highway maintenance man II.

Mamo Snooks, highway maintenance man II.

District XI

Ned H. Shobert, Sr., highway field office assistant.

Headquarters Office

Robert K. Breece, supervising highway engineer.

Owen W. Russell, highway engineering technician I.

Shop 4

Kenneth R. Hull, garage attendant.

Slipform Paving—2

By L. R. Gillis, Assistant State Highway Engineer, and
L. S. Spickelmire, Assistant Construction Engineer

(Second of two parts. See January–February issue for Part One.)

Delivery of Concrete to Paver

Central-mixed concrete is delivered to the paver in end dump trucks which back into dumping position on the subgrade in front of the paver. Normally, the trucks operate on the subgrade only for the limited distance in front of the paver necessary to line up properly into dumping position. In certain instances where space is limited, the contractors are permitted to use the subgrade as a haul road provided the trucks are not loaded in excess of legal load limits.

CORRECTION

Two numerical errors slipped through the first "Slipform Paving" article in the January–February issue.

On page 63, column 1, line 21, "1,800,000" should be "177,000."

On page 68, column 3, line 12, "60" should be "90."

Similar procedures are followed where the tilt-drum truck mixers are used.

Divided Into Boys

The front of the paver is divided into as many bays as there are lanes being paved. Trucks back into one or another of these bays to dump into the receiving hopper. In order to prevent these trucks from coming into direct contact with the paver the front plate of the receiving hopper in each bay is mounted so that it slides freely backward and forward independent of the forward travel of the paver. Five feet of travel between fixed stops is provided. It is the responsibility of the operator to control the forward travel of the paver so that the sliding plate is not against the backstops when a truck moves into dumping position.

The dump men must balance delivery of concrete across the width of

FIGURE 9—The sliding front plate on the slipform paver can seen just to the right of the three men in the photo below.

the paver and control the dumping rate. An unbalanced load on the paver may cause loss of traction at one of the tracks. This is especially true when paving three lanes at a time. Overloads, on the other hand, cause large variations in the forces acting on the concrete under the conforming screed and may well result in loss of traction at both tracks. The net result in either case is an area of excessively rough pavement.

In steep terrain we have found it necessary to run the paver downhill whenever possible for similar reasons. A recent project involving 6-percent grades and 12-percent superelevation is an example of three-lane-at-a-time paving in mountainous terrain illustrating the point. Paving was first attempted in an uphill direction on a 6-percent grade. Difficulty was immediately encountered.

Loss of Traction

The main problem at first seemed to be loss of traction, but with experience the dump men were able to overcome that by balancing the delivery of concrete and controlling dumping rate. While this improved the result, the paving continued to be unacceptably rough. Despite all his efforts, the contractor was unable to consistently meet specification tolerances until he changed the direction of paving. Paving downhill resulted in a reduction of the roughness of from nine to about three inches per mile.

At several points in our discussion we have indicated that the dumping rate must be controlled. This involves maintaining the truck cycle as uniform and continuous as possible and management of the rate at which individual trucks discharge their loads. Reasons for the latter have already been discussed and need no further elaboration. Maintenance of a uniform and continuous truck cycle is important for somewhat different reasons.

The most obvious, of course, has to do with the economics of truck operation. There are others which are equally compelling. Most relevant is the adverse effect on pavement smoothness produced by repeatedly stopping and starting the paver. It is practically axiomatic that the most satisfactory results are obtained where the paver is maintained at uniform speed. Since this, though, is dependent upon a uniform truck cycle, it is not always possible to attain. As a relative matter, it is much better practice to slow the paver to a creep rather than stopping it completely during any break in the truck cycle. But, this is only an expedient and not a substitute for properly balanced and supervised trucking operations.

FIGURE 10—A tout stringline is used to measure subgrade.

FIGURE 11—A closeup of the pavement edge immediately behind the slide forms.

Grade Wires

Piano wire stretched tautly between steel stakes parallel to, and offset from, each edge of pavement is used to provide grade and alignment control for the paver. These grade and alignment reference lines are commonly called "grade wires." They must closely parallel the desired profile for the edges of pavement. In practice, this means they are installed first by accurate measurement from the engineers' survey stakes and, secondly, by carefully sighting along the wire, correcting for any discrepancy either in the measurement or in the survey stakes.

The grade wires are offset approximately 30 inches laterally to provide room for the paver tracks, and approximately 8 inches vertically because of the location of the grade sensors. Since the position of the grade sensors can be readily adjusted up or down through a range of eight inches or so, the vertical offset to be used must be decided at the beginning of the job.

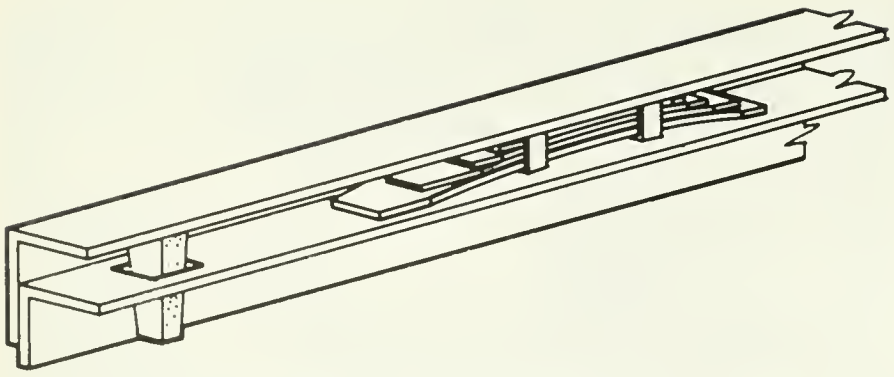


FIGURE 12—This sketch shows the makeup of the spring-loaded side forms.

FIGURE 13—Measurement of pavement thickness is accomplished by two techniques as shown in the above photomontage. Measurement by stabbing with a steel rod is shown in top two photos. Measurement of completed surface by measuring down from a stringline is shown in the bottom photo.

Because the pavement on many projects is interrupted, frequently by bridge decks at grade, there may be a tendency, for one reason or another, to use a different vertical offset in the installation of grade wires for some of the isolated segments of pavement. It occurred on one of our projects with very painful results. The vertical offset, in this instance, was established at eight inches. For some reason, the contractor changed the offset to seven inches in the area between two bridges, a distance of approximately 800 lineal feet. Although all key personnel knew of this change and had been briefed to adjust the grade sensors accordingly, it was entirely forgotten in the confusion of moving the paver across one of the terminal bridges. The result was 800 feet of 24-foot-wide pavement one inch deficient in thickness.

Survey Stakes

As mentioned earlier, the grade wires are sighted to detect and correct for any discrepancies in the survey stakes. Needless to say, such discrepancies are an ever-present hazard, and this hazard is incurred with each set of stakes used. If separate sets of stakes are used for the subgrade and the pavement, discrepancies between the two sets will affect the thickness of pavement.

For this reason, it is highly desirable to use the same survey stakes for both purposes. In practice, this means that horizontal offset of the grade wires from edge of pavement is considered when locating the stakes at the subgrade preparation stage. It is preferable that they be at the same offset so that a direct vertical measurement alone is required to set the grade wire.

Subgrade Preparation

In California, subgrade for concrete pavement is prepared by constructing a cement treated base to close tolerances for grade and cross-section. The treated base is required to extend one foot beyond each pavement edge. This is considered sufficient to overcome edge pumping, but it is not sufficient to extend the treated base to the full width of the paver tracks. In some instances, therefore, contractors

have extended it at their cost an additional 6 to 12 inches to provide a smooth, firm track path area for the paver to travel on. These are exceptional cases, though; in most instances, the untreated shoulder material compacted to proper grade has been adequate.

One of the more important problems with slip form paving is the difficulty of subgrading the base to the very tight grade tolerances requisite. It has yet to be completely resolved.

In an attempt to overcome it, most of our contractors are now employing automatically controlled subgrading equipment. Sensors and grade wires similar to those on the paver are used.

The most successful procedure at present involves subgrading for the treated base as carefully as for the pavement. When a uniform thickness of base is placed and compacted only slight trimming is required to obtain subgrade to reasonably close tolerances.

The primary control of pavement thickness is established by making certain that the subgrade is at a minimum offset below the grade wires at all points. This is accomplished by stretching a string taut over the grade wires at periodic intervals and measuring down to the subgrade every two feet transversely. High spots are then cut.

Side Forms

The length of sliding side form was a subject of much concern to us five years ago. Our concern was reflected in a requirement on our initial projects that 90 feet of trailing form be used. The thought was that the pavement edges would slump away if they were not supported by at least that length of side form. We soon learned that reducing the length of side form resulted in less rather than more edge slump. Accordingly, our current practice is to use only that length of form necessary to support the edges under the paver itself.

Proper design of the side form section proved to be a more troublesome problem than the length of form to be used. The original design provided for forms of monolithic cross section rigidly attached to the paver screeds. In depth they were only slightly less than that of the pavement. This was intended to allow them to clear the subgrade but prevent excessive waste of concrete. They were impractical because they "bottomed out" on local high spots in the subgrade or on particles of the coarse aggregate wedged between the forms and the subgrade. The paver would then be lifted above grade, causing roughness in the pavement. A floating action would also be induced by the extra concrete under the screeds, thus extending the area of roughness.

The solution finally devised was a two-piece, spring-loaded form design as illustrated in Figure 12.

With forms of this design, the upper part is attached to the screeds. The lower part slides on and adjusts to variations in the subgrade without exerting excessive uplift pressure on the paver. Excessive waste of concrete either over or under the side form is prevented, and local high spots in the subgrade do not result in rough pavement.

Internal Vibration

Internal vibration, as used on slip-form pavers of the type employed for three-lane-at-a-time paving, serves two distinct purposes. It compacts the plastic concrete and overcomes surface tearing under the conforming screed.

Early in our experience we conducted laboratory studies to determine what minimum amplitude and frequency were necessary to adequately compact concrete. These studies indicated that a frequency of 5,000 vibrations per minute is the practical minimum, and that the amplitude should be sufficient to be perceptible on the surface of the concrete more than one foot from the vibrating element.

In practice, these minimum requirements are fulfilled by a series of spud-type vibrators mounted in the receiving hopper of the paver. They are spaced laterally at 30-inch intervals and positioned ahead of the conforming screed at a distance approximately equal to the thickness of pavement. The latter dimension, determined empirically, is somewhat critical. If the vibrators are positioned too closely to the screed, the surge behind the screed is uncontrollable. If moved too far ahead of the screed, the load on the paver is greatly increased and excessive tearing of the surface is incurred.

The second purpose of internal vibration, as stated, is to overcome surface tearing. This is accomplished with a tube-type vibrator mounted along the entire width of the conforming screed at the leading edge. There is approximately two inches of clearance between leading edge and the side of the tube, and the bottom of the tube is about one-fourth-inch lower than the screed.

Manufacturers have made determined efforts to accomplish both of these purposes with either the tube vibrator or the spuds rather than using both. All of these efforts have failed. Either the compaction is inadequate, tearing is not adequately overcome, or the amount of surge behind the conforming screed is uncontrollable. Furthermore, the ability to compensate for variations in the concrete at

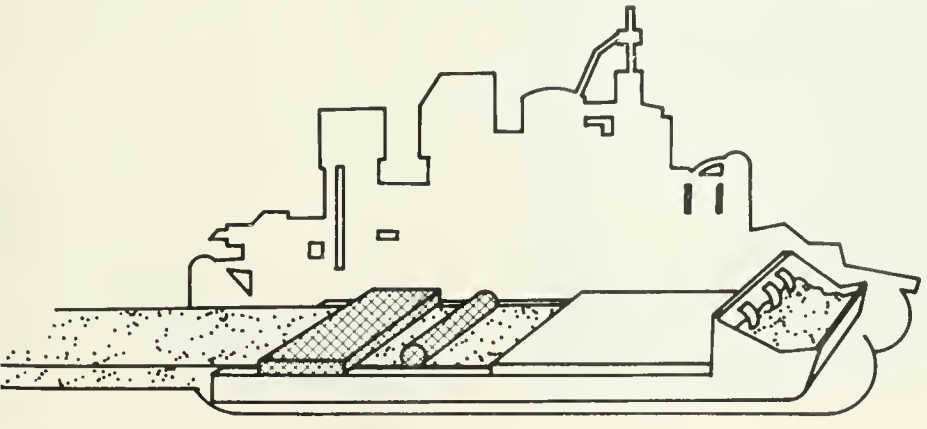


FIGURE 14—A sketch of the rotating screed and pan float arrangement.

the paver, as discussed more fully later on, is impaired.

Frequency of the tube vibrator need not be the same as for the spud-type vibrators. Best results have been obtained where means are provided for the paver operator to readily vary it between 3,000 and 5,000 vibrations per minute. This permits the operator to compensate for variations in concrete consistency; decreasing the frequency when the mix becomes wetter and surge behind the conforming screed increases, or increasing the frequency when the mix is dryer and tearing of the surface is encountered.

When a rotating screed is used behind the conforming screed the operator can judge when and how to vary the frequency by the amount of grout carried ahead of the rotating screed. An increasing amount of grout is a signal to decrease the frequency, and conversely for a decreasing amount of grout.

Several of the paver operators have become very skillful at this and are often able to anticipate adjustments by the appearance of the mix in the receiving hopper. Careful attention to the technique can result in a significant improvement of the pavement smoothness.

Surveillance Sensors

Another technique practiced by contractors is that of stationing men at each side of the paver to continuously attend to the operation of the control sensors. Many things can cause these sensors to get off the grade wires. A few moments of operation with any one of the sensors off the wire can produce roughness in the pavement requiring costly corrective measures. This is so costly as to more than offset the expense of two men to insure that it does not happen in the first place.

Pavement Thickness

Measurement of pavement thickness is accomplished by two techniques: stabbing the actual depth of concrete, and measuring down to the completed surface from a stringline.

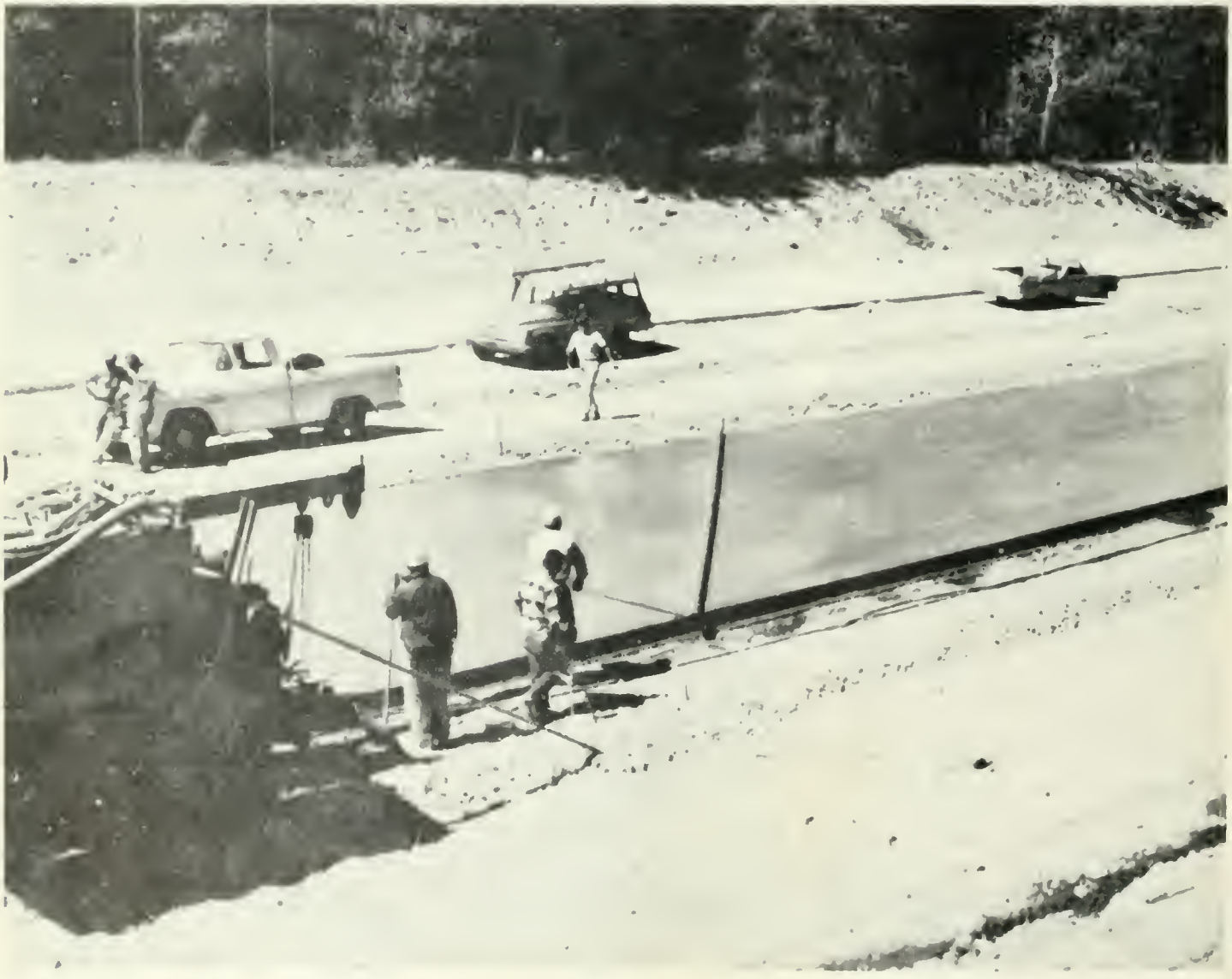


FIGURE 15—Pipe floating is accomplished by manually towing a six- or eight-inch aluminum pipe forward and backword over the surface with the pipe positioned diagonally across the slab.

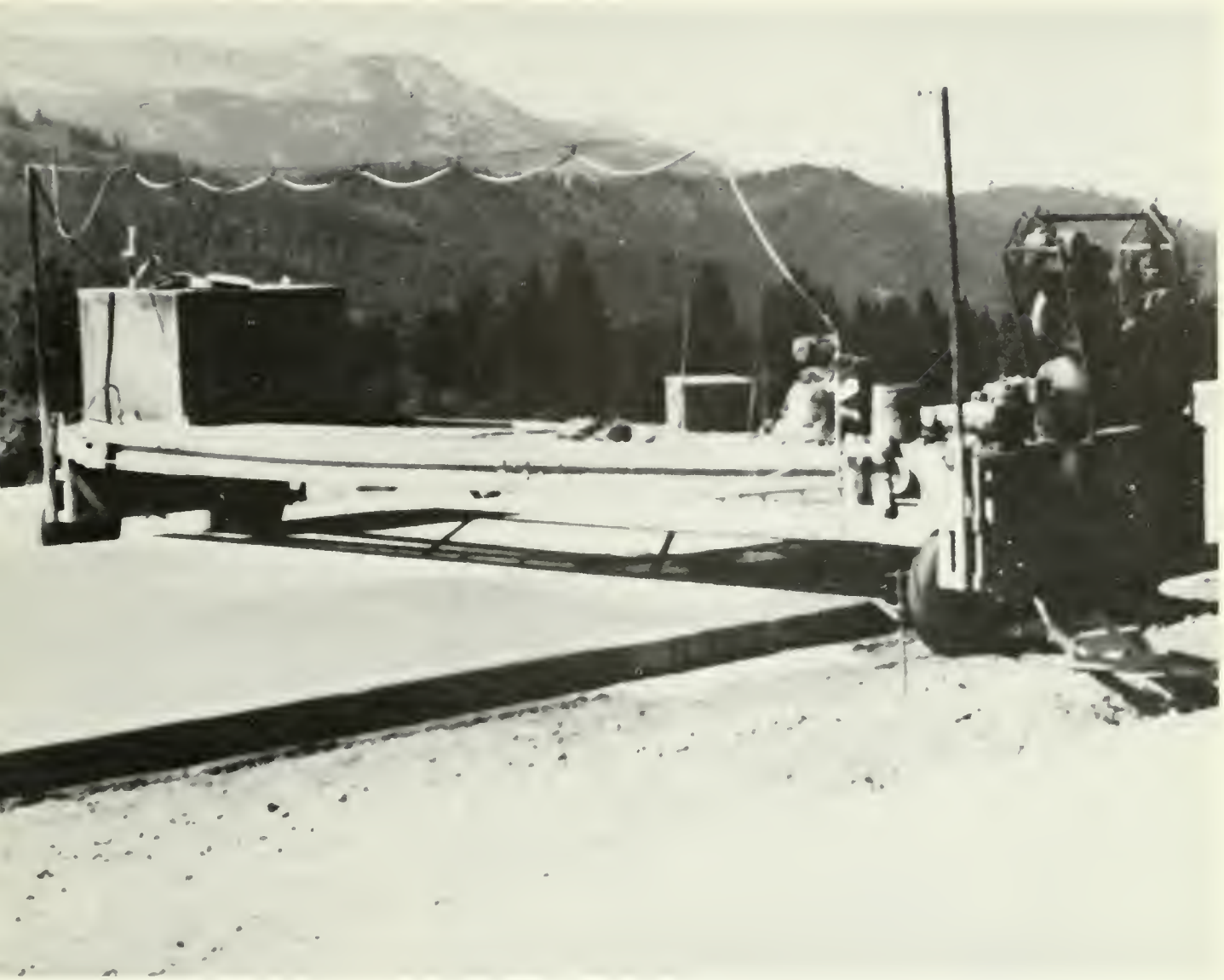


FIGURE 16—Two burlap drags are drawn longitudinally over the surface to produce a nonskid texture.

Stabbing the depth of concrete is performed at random locations immediately behind the paver. A calibrated steel rod one-eighth to one-fourth inch in diameter, which is marked to indicate the proper depth, is inserted carefully into the concrete and worked down until the end touches the subgrade. This technique is not precise, but it will quickly show up gross errors.

For more precise determination, measurements are made of the completed surface from a stringline stretched taut over the grade wires. The same locations at which the subgrade was measured are used so that the pavement thickness can be calculated by direct comparison of the data.

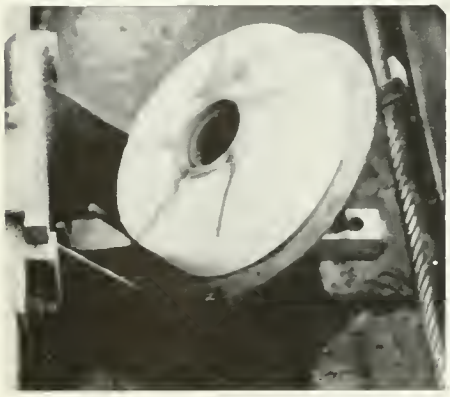


FIGURE 17—A closeup of a longitudinal joint installer.

Final Finishing

The final operation with the slipform paver is to float the surface utilizing several pan floats, or the combination of a rotating screed and a single pan float, which are attached to the paver. This removes minor imperfections and fills torn areas in the surface.

Final finishing consists of floating the surface with a pipe float, touching up and rounding the edges, and texturing the surface.

Pipe floating is accomplished by manually towing a six- or eight-inch aluminum pipe forward and backward over the surface with the pipe positioned diagonally across the slab. This action develops a small amount of

grout to eliminate minor imperfections and produce a uniform surface appearance.

Many contractors find it advantageous to straightedge the surface at this time when irregularities can readily be removed by the finishers. A 25-foot bow-type straightedge which utilizes a piano wire has been found to be effective.

It has been mentioned that reducing the length of side form reduces the amount of edge slump. While this is true, there is normally some slight amount which seems to be unavoidable. It can usually be corrected by careful operation of the edgers used to produce a ¼-inch rounding. Where this is not effective, a slight amount of fresh grout is worked into the surface at the edge.

Finally, two burlap drags are drawn longitudinally over the surface to produce a nonskid texture, and the cure is placed. White pigmented liquid curing compound, sprayed by machine at the rate of one gallon per 150 square feet, is universally used as the curing medium.

Joint Construction

For some years prior to introduction of slipform paving methods, California's joint practice was standardized. Longitudinal and transverse contraction joints were sawed. Contact joints were used between contiguous pavement slabs where they were placed at different periods, and at night joints. Expansion joints were used only where structures interrupted the continuity of the pavement.

FIGURE 18. Tiebars for longitudinal joints are placed by mechanical installers located in front of the conforming screed of the paver and are automatically actuated by a triggering device on the track assembly.

Dowels and joint assemblies were not used. However, tie bars 30 inches long were placed across all longitudinal joints and at all transverse contact joints. These bars of ½-inch reinforcing steel were spaced at 30-inch intervals.

Slipform methods made it feasible to substitute a joint insert for sawing in the construction of longitudinal contraction joints. A continuous strip of 4-mil-thick polyethylene plastic is now inserted by use of a vibrating keellike device attached to the paver. One of these installing devices is used for each longitudinal joint. The plastic strip is two inches wide and is provided in 3,000-foot rolls. It is installed in a vertical position with the top edge at or just below the pavement surface.

Sawing is still the conventional means of constructing transverse contraction joints.

Expansion joints are used only at structures, as before. However, since the slip form paver cannot place pavement flush against bridge paving notches, the practice has developed of leaving a gap of approximately 20 feet at each structure approach. These gaps are later placed and finished, using hand methods. This operation takes a great deal of care to avoid unacceptable roughness. Often these areas, and the night joints, are the only one requiring grinding to meet smoothness specifications.

Tie bars for the included longitudinal joints are now placed by mechanical installers on the paver. They are located in front of the conforming screed and are automatically actuated by a triggering device on the track assembly. This establishes the 30-inch spacing. The most successful installer used is a hydraulic ram assembly which is mounted on the back plate of the receiving hopper as shown in Figure 18.

Smoothness Measurement

It has been found desirable to determine compliance with smoothness requirements as early as possible. This is accomplished by use of the California-type profilograph which is essentially a 25-foot-long beam with a recording wheel at the midpoint and multiple support wheels at each end. It is operated over the pavement as soon as the concrete has hardened

GURE 19—A Californio-type profilograph, used to determine pavement smoothness, is operated over the surface as soon as the concrete has hardened sufficiently to support the instrument.

fficiently to support the instrument. ually during the morning of the first ıy following placement.

A continuous chart is obtained hich is analyzed quantitatively. The ımerical indices derived by this test rocedure must comply with specifiıtion tolerances.

There is reason to believe that the evelopment and use of this profiloraph has had an important influence ɔon a slipform paving in California. ot only has it made possible the esblishment of a standard of acceptɔle performance; it has also provided means of qualitatively appraising the ıving operation. The trace produced ı the profilogram represents a very ose approximation of the intimate rofile of the pavement. As such, it ın be used to examine the effect on ıvement smoothness of adjustments the paver, condition of the track path areas, superelevation and profile grade, operating conditions, and other pertinent factors.

In effect, it is a permanent graphic presentation, foot by foot, of the paver performance with respect to surface smoothness. Used with the log mentioned earlier, and supplemented with a detailed on-site inspection, it has materially contributed to progress.

Summary and Conclusions

1. In five years slipform paving has become the most common technique used to construct concrete pavement in California.

2. Cost estimates and the trend of bid prices indicate cost savings in excess of one dollar per cubic yard.

3. A higher level of technical ability is required of supervisors, operators and maintenance personnel.

4. Equipment manufacturers must be able to provide technical assistance in the maintenance of equipment.

5. Quality and uniformity of the concrete must be carefully controlled.

6. The subgrade must be very accurately graded, and improved subgrading equipment must be developed.

7. Increased production is not only possible but it is necessary to exploit the full advantage inherent in the method.

8. Proper use of internal vibration is essential for satisfactory concrete density and pavement smoothness.

9. Accurate adjustment and constant surveillance of automatic control elements are vital.

10. Pavement smoothness should be measured and recorded in a manner which permits adoption of rational standard of performance requirements and an early quantitative and qualitative appraisal of results.

Dillard Road

Major Highway Job Completed in Sacramento County Master Plan

By A. F. EFFINGER, Resident Engineer, Sacramento County

One of the major construction contracts to be completed in the 1964 program for the development of Sacramento County's Master Plan of Streets and Highways, was a federal aid secondary project known as the Dillard Road Extension, two miles east of Sloughhouse.

A portion of FAS Route 1223, located in the eastern part of the county, the extension commences at Meiss Road and continues 1.42 miles north, crossing the Cosumnes River, and connects with State Highway Route 16 (Jackson Highway), as shown on the accompanying map. Ultimate plans call for further extension northerly to a junction with FAS Route 1096 in the Folsom area. With the present rapid growth of Sacramento County expected to continue, an increase in traffic on this route can be anticipated due to development of residential subdivisions, commercial centers and industrial areas.

The project, which connects with Highway 16, also includes construction of a bridge over the Cosumnes River.

Replaces Substandard Road

The new alignment replaces an existing portion of narrow, substandard highway having poor vertical alignment, horizontal curves of 50–100-foot radius, and subject to periods of flooding from Deer Creek, a tributary of the Cosumnes River. Depending on the severity of the flooding, the highway was either closed or its use greatly impaired on an average of twice each year. Lo-

Looking northward along Dillard Road toward the Highway 16 junction.

ated about two miles downstream rom the new structure, the existing hrough steel truss bridge with timber pproach spans, was constructed about 906 and provided the only river rossing for many miles between the ommunity of Sloughhouse and the djacent agricultural area. Presently osted for a 12-ton load limit, the ridge will continue to serve light ocal traffic.

Constructed by A. Teichert & Son, nc., Sacramento, at a cost of $309,200, he new roadway and structure is ocated on one-half of a 110-foot ninimum right-of-way so that a par-llel roadway can be constructed in he future to obtain a divided multi-ane facility. The initial two lanes onstructed to FAS standards, consists f 24 feet of asphalt concrete on a 6-foot roadway, minimum curve adii of 2,500 feet and maximum rades of 2.86 percent.

Resting on steel H-piles and sup-orted on concrete wall piers, the ive-span reinforced concrete T-beam ridge, 350 feet in length, provides a lear roadway width of 28 feet be-ween barrier railings.

Designed for 33-Foot Clearance

Since it is subject to uncontrolled lood discharges, the structure was lesigned for a streambed clearance of 3 feet with a four-foot minimum igh water clearance, capable of pass-ng a 1-in-50-year flood of 55,000 econd-foot. A repetition of the 1955 flood occurred in December of 1964 when torrential rainfall produced a discharge estimated to be about 45,-000 second-foot without damage to either structure or highway, both of which remained open to traffic.

To simplify placement of concrete for the superstructure, the contractor resorted to an elaborote portable conveyor belt system.

Standard construction methods were employed by the contractor throughout all phases of the project except in the case of the superstructure concrete. Due to the location of the structure and with expected increases in river flow, the contractor decided to make the entire superstructure pour in one operation instead of several pours. Conventional methods of placing, using cranes or buggies were not considered feasible due to the size of the pour.

To place the 643 cubic yards of concrete, the contractor used twelve 32-foot electrically operated conveyors.

With the conveyors set in position along centerline of the deck, concrete was discharged from the transit trucks directly to the conveyor system at Abutment 6, then carried to its point of final deposit commencing at Abutment 1. The telescopic features of each conveyor, plus pivoting support frames, permitted the girder stems to be poured in advance of the deck section without too much difficulty.

At an average of 56 cubic yards per hour, 11½ hours were required to complete the successful pour. A standard vibrating strikeoff and longitudinal floats were employed for finishing operations.

he Dillard Road reconstruction looking north toward the bridge over the Cosumnes River in the distance. Grading for future addition of northbaund lanes can be seen to the right of the roadway.

Route Adoptions

Commission Adds 50 Miles Of Freeways on Five Routes

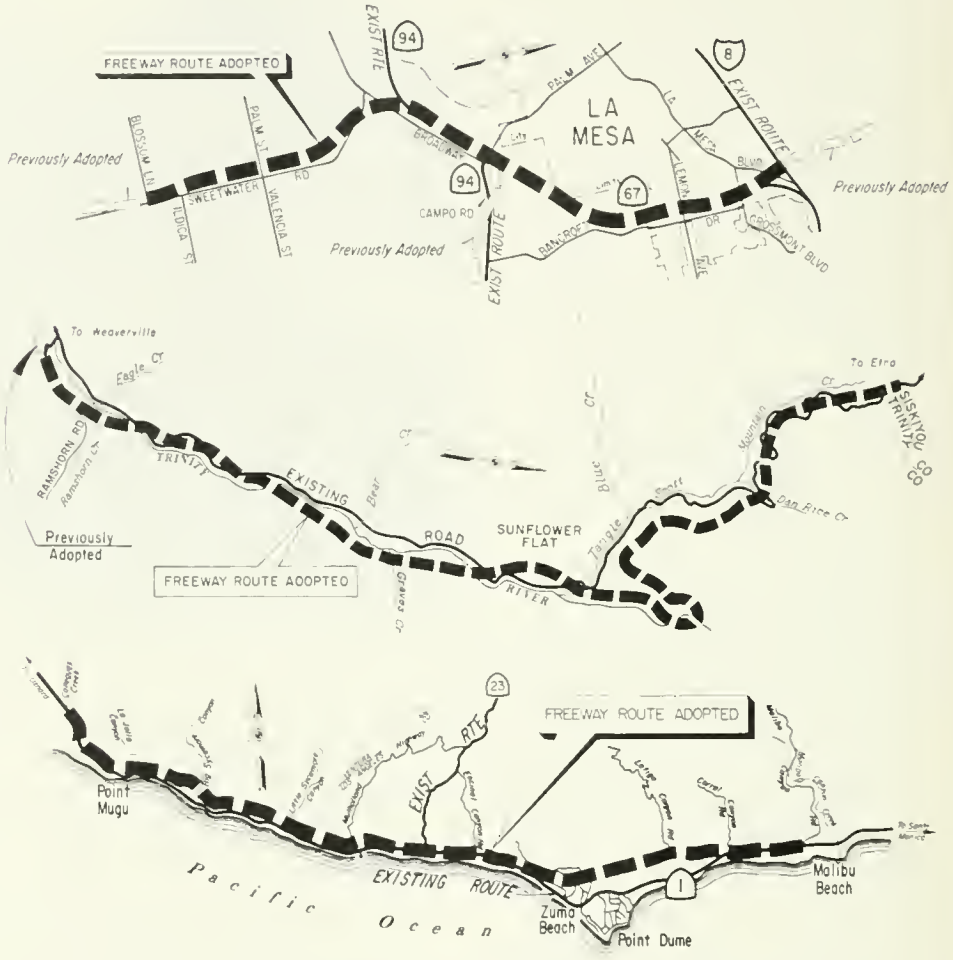
At its meetings in January and February, the California Highway Commission adopted locations for 50 miles of freeways on five routes.

The commission also reaffirmed an earlier adoption of 3.6 miles of Route 118 in Ventura County, following a second public hearing by the commission itself in January, and revised a two-mile section of a freeway location on Route 1 in Los Angeles County that it had adopted last September.

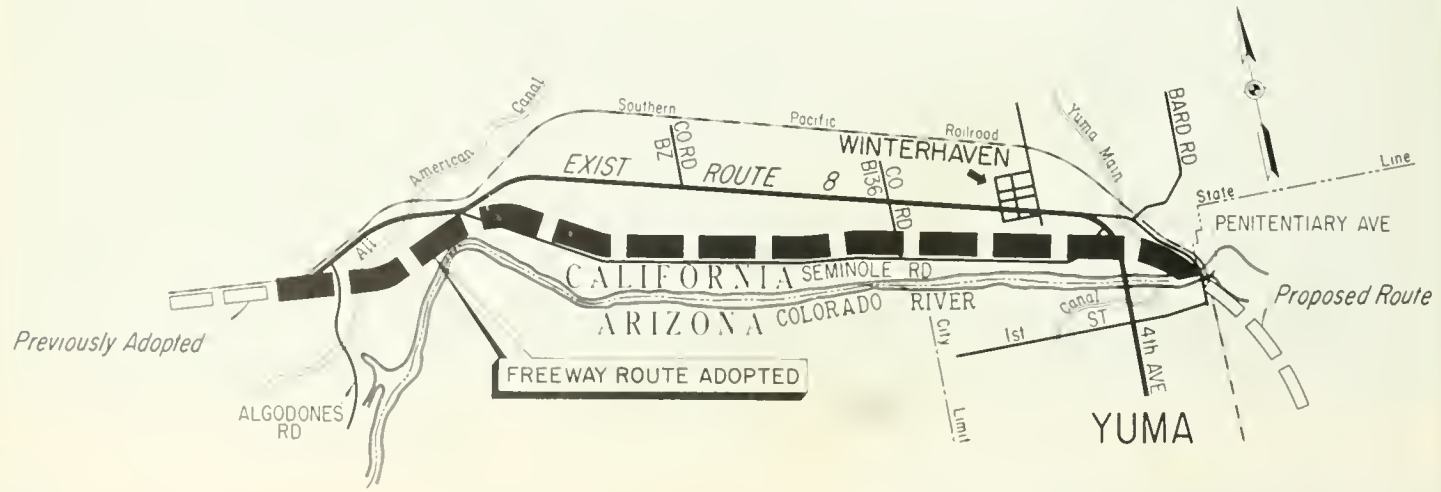
The 3.6-mile segment in Ventura County, between First Street and Patterson Ranch Railroad Spur near Tapo Street in the Simi area, is part of a 12.2-mile section, between Madera Road in Ventura County and 0.3 mile west of De Soto Street in the Chatsworth area of Los Angeles County, that was adopted in March 1962.

The commission had held the second public hearing to consider a possible shifting of the adopted route slightly to the north which had been recommended by the State Highway Engineer. His recommendation, in turn, had followed a public hearing on the matter conducted by the Division of Highways in Simi in March 1964.

In reaffirming the original adoption, the commission concluded that no substantial changes or new evidence had developed to warrant a change. It also noted that while the ownership of the greatest number of acres affected by either routing favored the revision, the greater number of individual property owners favored retention of the adopted route.



The commission had adopted a 23.3-mile location for the Route 1 Freeway, between Malibu Canyon Road in Los Angeles County and Calleguas



Creek in Ventura County, at its September 1964 meeting. However, it had ordered a restudy of the adopted route and a possible alternate for a two-mile section (between east of Busch Drive and west of Trancas Canyon Road) in the Malibu area because of recent residential construction along the adopted line near Trancas Canyon.

Of the two, State Highway Engineer J. C. Womack had recommended the alternate which would bypass the recent development to the south, requiring 36 fewer improvements and saving $3,100,000 in costs. He said the alternate, identified as "Connector Seven" at a public hearing conducted by the Division of Highways in Los Angeles in December, would provide comparable traffic service, and would have more favorable grades, thereby reducing cuts and fills.

In other freeway adoption actions, the commission located routes as follows:

El Dorado County: 24 miles of US 50 between Riverton and one-half mile east of Phillips, completing freeway location for the entire length of this route between Sacramento and the Nevada line.

Trinity County: 13.8 miles of Route 3 between 4.6 miles north of Coffee Creek and the Siskiyou county line.

Imperial County: 6.3 miles of Interstate 8 between west of Algodones Road and the Arizona border at Yuma, connecting with a routing proposed by the Arizona Highway Department.

San Diego County: 4.1 miles of Route 125 between Blossom Lane in the South Springs Valley area and Interstate 8 in La Mesa.

The commission also adopted as conventional highways:

Santa Barbara County: A 0.2-mile revised routing of Route 224 between US 101 and Carpinteria Beach State Park.

Los Angeles County: 0.4 mile of Vineland Avenue in Los Angeles between the Hollywood Freeway and Lankershim Boulevard as Route 170. (In a related action, the commission relinquished the portion of Lankershim Boulevard between the Hollywood Freeway and Vineland Avenue, formerly part of Route 170, to the city.)

DEPARTMENT MARKS RETIREMENT OF 46 EMPLOYEES

District I

George C. Abarr, highway foreman, 36 years; Leonard F. Craig, highway maintenance man II, 30 years; Edward J. Doering, highway maintenance man II, 28 years; Byron A. Griggs, highway foreman, 24 years; Lloyd A. Moore, highway maintenance man II, 31 years; Norman A. Pratt, highway engineering technician I, 9 years; Lyle G. Schlosser, janitor, 5 years.

District II

W. Hiram Bartlett, highway engineering technician I, 39 years; Ora Harold, highway maintenance man II, 18 years; James C. Phipps, highway foreman, 17 years; Chester D. Wagner, highway maintenance man II, 33 years; Arthur F. Waugh, highway maintenance man II, 15 years.

District III

DeWarren Bridges, delineator, 8 years; John W. Colman, highway maintenance man II, 11 years.

District IV

Roy E. Hansen, highway maintenance man III, 29 years; John F. Madden, associate right of way agent, 10 years; Wilder G. Morey, associate highway engineer, 30 years; Joseph J. O'Connor, highway landscape maintenance man, 2 years; William Sadler, highway landscape maintenance man, 5 years.

District V

Gaius W. Abraham, highway foreman, 28 years; Ralph J. Moon, highway maintenance man II, 33 years; Mabel L. Rianda, intermediate clerk, 8 years.

District VII

George C. Ebling, highway engineering technician, 4 years; Eula C. Jacob, supervising account clerk II, 40 years; John R. Rouppe, highway maintenance man III, 26 years.

District VIII

Wayne H. Crawford, senior highway engineer, 35 years; Mary B. Gaffko, varitypist, 9 years.

District IX

Daisy M. Powers, highway field office assistant, 17 years.

District X

Theodore L. Ashworth, highway foreman, 37 years; John T. Houlihan, highway foreman, 36 years; Francis P. McHugh, assistant highway engineer, 9 years; Gloria F. Ruff, dispatcher clerk, 9 years.

Headquarters Office

Wilson A. Madsen, highway engineering associate, 15 years; Henry C. McCarty, principal highway engineer, 34 years; Joseph J. Ralph, audiovisual assistant, 17 years; Ferdinand J. Volkert, senior highway engineer, 30 years.

Bridge

Boyington J. Chrysler, highway engineering technician I, 19 years; Ila E. Stephenson, senior account clerk, 21 years; Everett L. Walsh, supervising bridge engineer, 36 years.

Materials and Research

John R. Vincent, assistant steel inspector, 10 years.

Shop 2

John M. Harris, highway equipment superintendent II, 22 years.

Shop 5

Harry J. Kohlstedt, automobile mechanic, 31 years.

Shop 7

Pierre O. Parish, automobile electrician, 22 years.

Shop 8

Mary F. Milnor, accounting technician II, 37 years.

Headquarters Shop

Harold L. Emrick, highway mechanic foreman, 23 years; Ella Mae Wilson, intermediate account clerk, 14 years.

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"Before and after" photos of US Highway 199 in the Smith River Canyon. Upper photo was made on January 18, 1965, when subgrade was partially rebuilt, and lower photo, showing completed highway, as yet unsurfaced, but carrying normal traffic, on February 24, 1965. (See article beginning on page 2.)

Smith River

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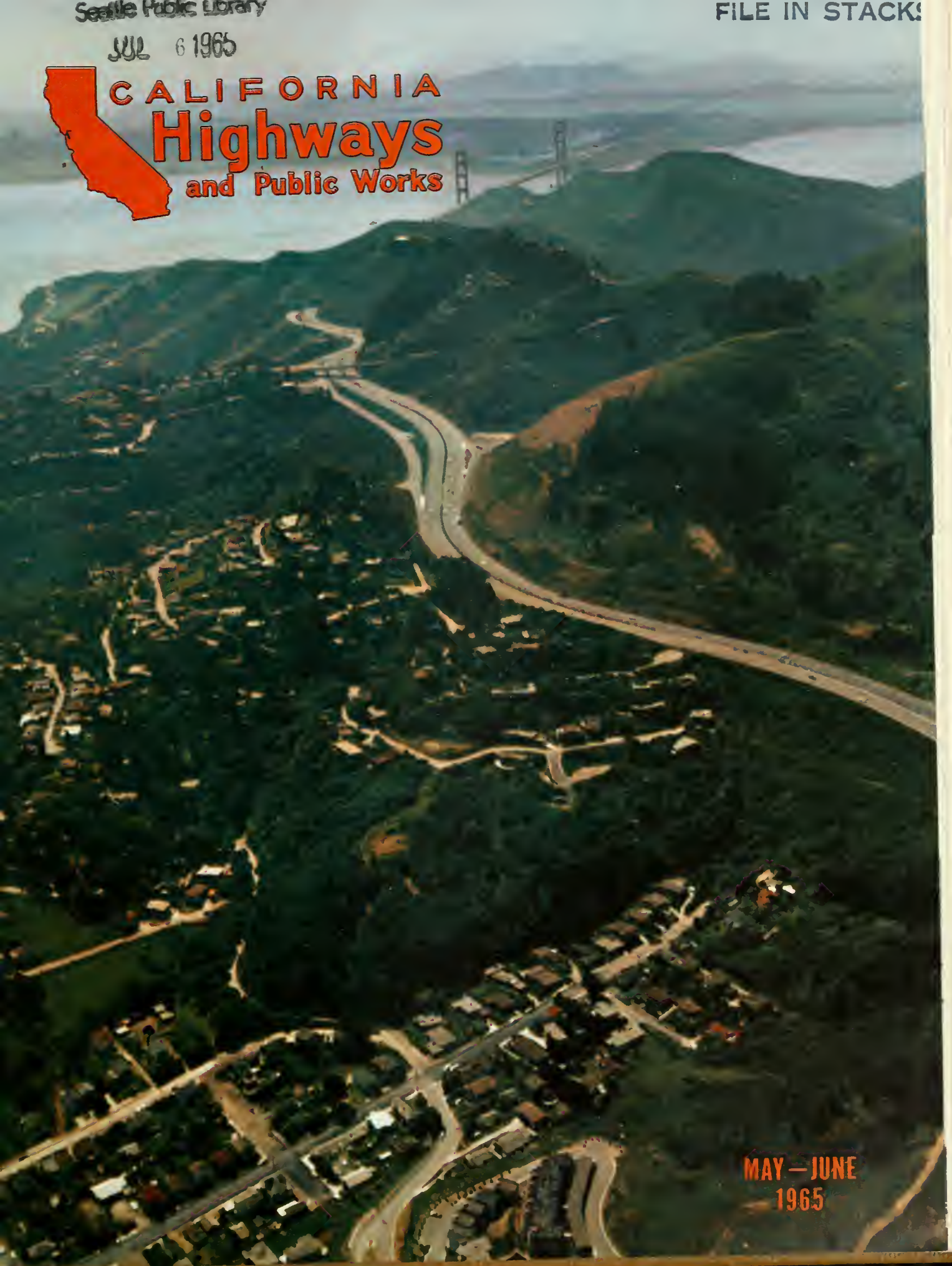

MAY—JUNE
1965

The extensive cuts and fills involved in widening Waldo Grade on US 101 north of the Golden Gate Bridge a decade ago were so impressive that the Museum of Modern Art in New York City was prompted to include this project in an exhibition on 20th Century engineering feats. Although it was difficult to realize at the time, the handiwork of nature was to play an important part in the final appearance of the slopes. Native shrubs and grasses seeded during construction have now mingled with other natural growth to provide greenery which unifies engineering and aesthetics.

The Natural Restoration of Waldo Grade

California Highways and Public Works

Official Journal of the Division of Highways, Department of Public Works, State of California

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FRONT COVER: The verdant hills found on US 101 immediately north of the Golden Gate Bridge are the subject for the picture feature on the inside front cover. A full roundup of highway progress in District 4 which contains this route begins on page 24. *(Photo by Jack Meyerpeter.)*

BACK COVER: The abstract pattern of steel and concrete was photographed during construction of the W-X Street Bridge being built over the Sacramento River to carry Interstate 80 through the state capitol. Completion of the bridge and freeway approaches is scheduled for late in 1966. *(Photo by Peter Asano.)*

Yuba Pass Highway

Four Miles of Highway 49 Improved in Sierra County

By CHARLES H. CHAPPELLE, Highway Engineering Associate

Four miles of widened and realigned State Highway 49, built to two-lane expressway standards, were completed last summer in mountainous central Sierra County through some of the most scenic country in the state.

The project is a classic example of the careful planning and design of a rural two-lane mountain highway which is a part of both the California freeway and expressway system and the scenic highway system—where the natural scenic beauty and unspoiled atmosphere were protected and in fact enhanced.

Recreational areas and points of historical interest were not only preserved, but actually made easier to get to. Access to the highway is controlled by limited driveways and public road approaches, and there is no conflict with the highway's duty to provide an adequate trafficway, and, at the same time, insure availability to the wide range of fishing, hunting and vacation spots.

Historic Highway 49, promoted as the Mother Lode Highway by the Golden Chain Council, extends some 315 miles north from Oakhurst at the junction of Highway 41, south of Yosemite National Park, to Vinton in Plumas County at Highway 70. The entire road was included in the scenic highway system by the 1963 Legislature, and the portion from Auburn to Vinton is a part of the freeway and expressway system established in 1959.

(For the history and detailed status of Highway 49, see "Highway Through History" in July–August 1963 *California Highways and Public Works*.)

A section of the new Yuba Pass highway through a densely wooded area. Road at right is private.

A typical section of the old highway before widening and improvement. Slope cuts (right) were through old glacial material of round, loosely packed rocks which presented a tough maintenance problem of constant sloughing and falling rock resulting from the freeze-thaw cycle in winter and spring.

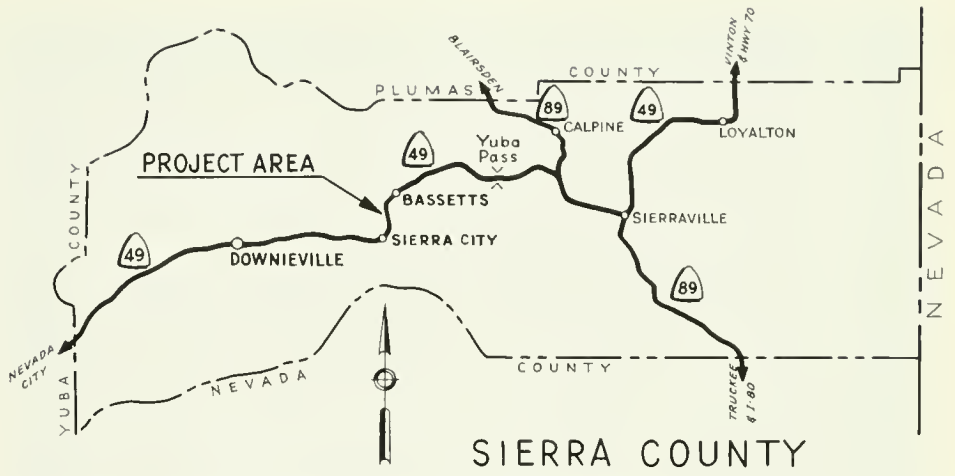
Canyon Often Steep, Narrow

There are 65 miles of the route in Sierra County—from Yuba County on the west to Plumas County north of Loyalton in the northeast. Most of Highway 49 in western and central Sierra County, between the Yuba County line and west of Yuba Pass, shares a narrow and often steep canyon with the North Fork of the Yuba River through both the Tahoe National Forest and private land.

The section which is the main topic of this article reaches from a point beginning 0.7 mile east of Sierra City to old Bassetts Station, and is known locally as the Yuba Pass Highway. Sierra City, an unincorporated community of about 225 persons, is 12½ miles east of Downieville, the county seat. Yuba Pass is seven miles east of Bassetts (see maps).

Elevation at the beginning of the project is 4,575 feet above sea level, and at Bassetts, 5,378. Yuba Pass, over the top of the Sierra Nevada range, is at elevation 6,708.

The Yuba Pass Highway passes through an increasingly popular tourist and vacation area due to its natural scenic grandeur and recreational opportunities. Best known, and perhaps most frequented, is the Sierra Buttes recreation area north of Bassetts via Gold Lake Road—a region of 29 high-altitude lakes and 400 miles of streams, draining mostly into Salmon Creek which flows into the North Yuba River. Among the most popular are Sardine Lake and Gold Lake. The latter drains into the Feather River



Map showing the general location of the project between Bassetts and Sierra City in Sierra County.

The Sierra Buttes provide an imposing backdrop for a section of the widened roadway at Manzanita, near the east end of the job.

Map showing the limits of the highway construction discussed in this article.

An aerial view looking eastward up the North Yuba River canyon near the eastern end of the project.

An aerial view looking westward from the east end of the project. The thin line across the face of Sierra Buttes (background) is a road to a mine built in 1878.

in Plumas County by way of Frazier Creek.

Good Fishing, Campgrounds

The region is an area of excellent fishing and features numerous public campgrounds under U.S. Forest Service supervision, and many private resorts.

In fact, the county itself was named after the Sierra Buttes (peak elevation 8,752)—the majestic, towering landmark visible from this stretch of highway. They are strikingly dramatic when capped with snow against a crystal blue sky.

Of historical interest is that gold was discovered in the North Yuba country in 1849, and in 1869 the "Monumental Nugget," weighing 141 pounds, was found at Sierra City. It was one of the world's largest.

In gold rush times some of the roads, little more than widened trails in some cases, were subject to tolls and located on the south side of the river. The present route, on the north side of the Yuba, was first graded in 1924–25 as a forest highway project. In 1937 two inches of gravel base and two inches of road-mixed gravel was placed by the Division of Highways.

Little improvement has been made since then. State maintenance forces have continued to reprocess and patch to keep it traversable. Some widening was done in places.

Improved Alignment

Prior to the recent contract, roadway width was from 16 to 20 feet and, although the new section generally follows the old—crossing and recrossing it—many improvements in alignment were made for better sight distance, more comfortable riding, and safety.

The former 300-foot minimum radius curves and grades of up to 7 percent were replaced with 850-foot minimum curves, to provide a 50-mph design speed, and a maximum grade of 6 percent.

The new stretch is a 32-foot all-paved section with two inches of asphalt concrete over six inches each of aggregate base and subbase. Also part of the contract was a new reinforced concrete box girder bridge over Salmon Creek in the eastern quarter of the project. Built about

00 feet downstream from the old ridge, completed in 1932, it is a ree-span structure, 252 feet in length nd 32 feet wide.

At picturesque Big Springs, about idway in the job, a paved safety st area was provided for off-highay parking. Big Springs is in effect group of small, sparkling waterfalls oursing over moss-covered rocks rough wild fern and azaleas at the de of the road. The water is delious—the overflow from two springs gher above the highway on the ountainside—a favorite stopping and atering place for generations of otorists and the pioneers before em. The runoff is carried beneath e parking pad and roadway into e Yuba River by a culvert.

The Big Springs safety rest area looking east. The paved parking area is actually a reconstructed portion of the old highway.

Flood Danger

Although usually peaceful, the North Yuba can become one of the ildest and swiftest rivers in the north ierra area under flood conditions. nd, since the highway is alongside many points, it was a challenging esign problem to provide protection gainst this river which, when rag-ag, can move 80-ton boulders with ease. In addition, the river had to be realigned at three places to accommodate line changes in the roadway.

Contractor for the $1,450,000 job was McNamara Corporation Limited of Burlingame, a Canadian firm of Toronto, Ontario. General manager was C. A. Peterson, and superintendent at completion was Red Reusser.

Construction engineer for the state was Don Young. Kenneth R. Bailey was State Bridge Department representative and the author was resident engineer.

For an additional three-quarters of a mile, as the second phase of work in this area, construction is expected to start later in the year on the piece from Sierra City to the beginning of the completed unit (see map). It, too, will be a 32-foot section. $190,000 has been budgeted.

The new Salman Creek Bridge, looking east. The old bridge, built in 1932, was about 400 feet upstream (left and was demolished.

Bradley-San Ardo

Monterey County Gets 12 Miles of New Freeway

By ROY E. ALDERMAN, District Construction Engineer

Completion of 12 miles of new freeway between Bradley and San Ardo in Monterey County last year reduced by approximately one-fourth the remaining two-lane highway on US 101 in District 5.

The area surrounding this section of US 101 is devoted to grain farming and grazing. Individual land holdings are generally large, consequently, the population density is quite low. The only land use other than agricultural is the San Ardo Oil Field. The oil field is located in the northern third of the project, with oil wells on both sides of the highway. This field has been operating for many years and appears to be fully exploited.

The old highway was constructed under two contracts; the north half was a part of a project completed in 1933 and the south half was completed in 1937. Both contracts called for a 36-foot roadway with two 10-foot lanes of portland cement concrete and oil treated shoulders.

First Self-loading Scrapers

The 1933 contract is believed to have been the first contract in this dis-

The new Bradley-San Ardo US 101 freeway looking southward from above the San Bernardo Overcrossing. Salinas River at left.

Limits of the freeway project were from 1.2 miles north of Bradley to 1.7 miles south of San Ardo in Monterey County.

Looking eastward along Jalan Road toward the new freeway which crosses over on the bridge.

trict where self-loading, self-dumping scrapers were used. The contractor, M. J. Bevanda, used two Le Tourneau nine-cubic-yard scrapers towed by 60-horsepower tractors. The cutting edge and ejector was powered by electric motors mounted above the scraper bowl.

The old two-lane highway was on good alignment, but narrow lane widths and the rolling grade contributed to a fairly high accident rate. Although the passing sight distance on the old road was substandard for a two-lane facility, it was satisfactory for a four-lane divided highway. Consequently, since alignment and location were good, much of the existing highway could be salvaged.

Salvaging was accomplished by widening to current standards and strengthening the structural section. The widening and conversion to a four-lane facility should eliminate the causes of most of the accidents. The structural elements of the widened area consisted of 0.67-foot cement-treated base over 0.17 foot of aggregate base and 0.50 foot of aggregate subbase. The entire traveled way was then covered by 0.33 foot of asphaltic concrete.

Two Lanes Constructed

The new lanes were constructed of 0.67 foot of portland cement concrete, 0.33 foot cement-treated base over 0.17 foot of aggregate base and 0.50 foot aggregate subbase. The 0.17 foot of aggregate base is standard practice in this district and is used to provide a working table over a generally cohesionless sand subbase material.

The contractor elected to place the portland cement concrete pavement in two 12-foot lanes using sideform

A ground view of the San Bernardo overcrossing shortly after its completion. The view is north.

The old highway was built in 1933. This contract was the first in District 5 where self-loading, self-dumping scrapers were used.

construction. Although this method is no longer in general use, the equipment and methods have been thoroughly refined through the years and the resultant pavement has excellent riding qualities. There were no local aggregates which met our specifications for portland cement concrete, and these aggregates were hauled from a commercial source near Watsonville, approximately 90 miles away. The concrete was dry batched in 1½-cubic-yard batches and hauled to a 34E mixer from a batch plant located on private property near the center of the project.

The general plan for traffic handling was to leave traffic on the existing lanes while completing as much of the new lanes as possible. Traffic was then shifted to the new lanes and the existing roadway was widened and strengthened. Through most of the project the new lanes were constructed as a separate roadway with the grade differential between the two roadways between 5 and 15 feet.

A typical section of the completed freeway between Bradley and San Ardo on US 101.

Interchanges Also Constructed

Three interchanges were constructed as a part of this project. The most southerly is at the Jolon Road intersection, where Jolon Road, the only public road intersecting this project, makes a "T" intersection with Highway 101. Jolon Road extends to the west serving an extensive agricultural area and the Hunter Liggett Military Reservation.

The new interchange at this location was essentialy an expansion of an existing two-lane interchange. The existing undercrossing structure became a part of the southbound lanes. A parallel bridge was constructed to carry northbound traffic. Most of the existing ramps were salvaged and incorporated into the interchange by resurfacing and adding curbs.

Two additional interchanges were constructed as the least expensive way to provide access for local property owners. Both of these interchanges were constructed as elevated overcrossings and diamond-type ramps. The overcrossing structures were both four-span with the two center spans being on precast, prestressed concrete girders. The short end spans were cast in place.

While this section of California is regarded as relatively dry, considerable ground water was encountered between Stations 190 and 250. During grading operations it was necessary to remove a large amount of saturated material below the grading plane. The subexcavation was then backfilled with river sand, one-foot layer of permeable material and a system of perforated metal pipes, side ditches and sand drains.

Extensive contour grading was done each interchange and in the area of separate roadways. The resident engineer used surplus roadway excavation and a small amount of additional grading to flatten slopes and blend the fills into the surrounding terrain.

This project was the first of six projects planned to complete the freeway between San Miguel and just north of King City. Two of the remaining five projects are presently underway and will close the gap between the existing freeway at San Miguel and the south end of this project. The first of these, from San Miguel to north of the main gate at Camp Roberts, is expected to be completed by summer of 1965. The second unit, which lies between these two projects, is expected to be open to traffic by spring of 1966. The three projects to the north will fill the gap between the existing four-lane section north of King City and the north end of this project. The first of these will be a three-mile project in the vicinity of King City. Design and right-of-way acquisition are nearly completed on this unit. The second unit will extend the freeway to the south to a point just north of Route 198 at San Lucas. Design is under way and right-of-way acquisition will begin this year. The last unit—between San Lucas and San Ardo—will complete the four-laning of this 46-mile section. It is in the early stages of design.

The estimated cost for the 46 miles between San Miguel and north of King City is $24,000,000.

The recently completed freeway was started in April 1962 and was completed in August 1964. Cost of the completed project was approximately $3,540,000. The Contractor was Madonna Construction Company. The resident engineer was D. E. Connolly.

Statewide Transport Space Age Study Authorized

Governor Brown has announced that the Los Angeles Division of the North American Aviation, Inc., has been awarded a $100,000 contract to make a space age study for a statewide transportation system.

The contract is the fourth in a series of studies being undertaken by the aerospace industries to apply advanced systems engineering methods to state and local problems.

The study will encompass these major objectives, Governor Brown said:

1. Identifying major patterns of movement of people, merchandise, materials, and food within and between the major metropolitan areas as well as in the rural and smaller urban environment.

2. A consideration of road, rail, water, and airborne vehicles, private and commercial carriers, and any novel means of transport justified for evaluation.

3. A definition of 30- to 50-year objectives toward which the state should strive in terms of the composition, layout and control of the network.

Some 18 nationally famous aerospace companies bid on the transportation study contract. The Governor said that to evaluate the proposals, a committee consisting of urban planners, highway economists and traffic engineers was selected. The three finalists were subsequently interviewed by the State Highway Engineer, the Office of Planning in the Department of Finance and members of the committee.

The Governor pointed out that this year there are 9.5 million vehicles in California and that by 1990 there will be 24.5 million.

"We estimate that vehicle travel alone in 1990 will total 245 billion miles," Governor Brown said. "And by the same year we will have had to spend $25 billion on city, county and state roads and highways to keep up with the growth of automobile and truck traffic."

Equally important, he said, are other transportation needs: mass rapid transit for the cities, and air, sea, and rail travel.

Previous contracts for aerospace studies have been awarded to Space General Corp., of El Monte, for a study leading to more effective methods of combating crime and delinquency; Lockheed Missiles and Space Co., of Sunnyvale, for a state information system; and Aerojet-General Corp., of El Monte, for a study of waste management.

The aerospace companies are being asked to employ the new scientific principles of problem solving, discovered in space, missile and defense work, in studying state problems. In addition to providing the state with new insights and ideas, it is anticipated that the companies may develop programs for converting some of their engineering, scientific and technical resources to civilian purposes, the Governor said.

In its proposal for the contract, North American took this futuristic view of the transportation needs of California:

"Rockets taking Californians to New York in minutes; tube trains with San Francisco to Los Angeles times similar to today's jets; individual air cars from home to office; hands-off control of all vehicles on throughways; automated pipeline movement of produce from farm to home in hours; continuous flow of mail from dropbox to destination; easy access to areas of recreation without destroying natural beauty; smog-free cities with tree-lined walkways—all and more are feasible within California in the next 50 years."

L. L. Waite, senior vice president in charge of contracts and programs for North American, said in a letter of transmittal with the company's bid proposal that the "systems approach" to problem solving could be applied to an integrated study of transportation in the state.

"A study group of specialists representing scientific, engineering, social, and other disciplines drawn from throughout the corporation will be designated to perform this work," the company said.

Wrong-way Drivers

Cooperative Study Outlines Problems, Possible Solutions

This article was originally prepared by Information Officer Robert E. Nance as a series of four write-ups for newspapers on wrong-way driving, corrective signing and spike barriers.—Editor.

Beware of sober 47-year-old men driving in moderate traffic on unfamiliar freeways or expressways during daylight hours on Saturdays when the weather is clear—statistically, this is the person most likely to be a wrong-way driver.

He is not, however, the driver most likely to kill you, himself or others as a result of his misguided sense of direction. This composite prospective killer is a man 10 years younger who departs a bar after its legal 2 a.m. closing hour, crawls into his car and then can't find the right way home.

That overly maligned female—the woman driver—emerges almost blameless when compared to her masculine counterpart, for she is the cause of only one out of five of California's wrong-way driving incidents.

These facts, along with many other pertinent details, are contained in a research project report, "Wrong-way Driving," recently released by the California Division of Highways. The study was conducted in cooperation with the U.S. Bureau of Public Roads. Assistance was provided by the California Highway Patrol and the city police of Los Angeles, San Diego, Long Beach and Riverside.

The report examines 1,214 wrong-way incidents and accidents and is aimed at gathering facts as a basis for stepping up the attack on the wrong-way driving menace. More important, researchers hope it will assist them in decreasing the number of accidents caused by such traffic violations.

Chance of Survival Poor

The study shows that your chances of surviving a wrong-way accident are so poor that they would discourage a professional gambler. In 1963, the ratio of persons killed in all freeway accidents was 2.4 per 100, but when only wrong-way mishaps were considered, it soared to 14 dead per 100 accidents.

During the total four-year period considered, 126 people died and another 150 suffered serious injuries in the 83 fatal wrong-way accidents that happened on freeways. Traffic engineers, still analyzing last year's statistics, predict that 1964 will prove to be even worse.

Tests showed that phrase "WRONG WAY" was best understood by erring drivers.

Fortunately, wrong-way accidents account for a minor percentage of the total traffic accidents which occur each year on freeways.

But the severity of this type of collision is made obvious by an extract from the 1963 California traffic accident reports which show that 39 victims died in 30 fatal crashes included in the total 279 wrong-way accidents that occurred on freeways and expressways that year.

On 23 of these deadly occasions, law enforcement officers were able to ascertain the physical condition of the offending driver and 15 proved to have been drinking to the degree that their driving ability was obviously impaired; 5 had been drinking to a lesser degree; and 2 were suffering from obvious physical defects. Only the remaining two were apparently fit to drive.

The percentage of unfit drivers (78.1 percent) whose wrong-way driving resulted in somebody's death during the years 1961–1964 was deplorable. Of 83 such violators, officials discovered that 50 had been drinking, one had suffered a diabetic attack, only 13 were sober, and the physical condition of the remaining 19 could not be determined.

Drunk Drivers Favor Off-ramps

Although less than half of all wrong-way drivers get that way by entering a controlled access highway via an off-ramp, almost two-thirds of the drinking drivers embark on their illegal trips from such a point. Apparently a drunk believes in following the shortest route possible when driving between two points.

And it is the same stubborn drunk who is primarily responsible for the 6 percent of all wrong-way driving incidents occurring at about 2 a.m.—when only 1 percent of the total miles of vehicle travel takes place. The rate drops very rapidly after that hour.

The age of drivers developed into a significant factor during the course of the study and a pattern correlating age and the use of alcohol emerged.

Slightly more than a third (36.7 percent) of the 1,214 wrong-way drivers stopped by police had been drinking.

Of the total number apprehended, 137 were more than 70 years old but only 8 (5.8 percent) of this group had been drinking.

An increase was noted among the 60–69 age group, for 22 (12.7 percent) of 173 persons had been drinking.

The trend continued to rise as the age bracket lowered, for among the 50–59-year-olds, 82 (39.1 percent) of the 210 drivers involved were in the "had been drinking" category.

In the 40–49-year-old group, out of 37 persons stopped, 118 (49.8 percent) showed the influence of alcohol.

The 30–39 age group was the peak hit. Of 226 such wrong-way drivers observed by law enforcement officers, 133 (58.9 percent) had been drinking. However, the rate plummeted sharply when the youngest group, 16–29 years old, was considered. There were 65 (34.6 percent) drinkers among the 187 wrong-way offenders.

The mean age of all drinking wrong-way drivers was 41.8 years and that of sober wrong-way drivers was 40.9 years.

How Drivers Go Wrong

Freeways and expressways save hundreds of lives in traffic each year; but they are also the spawning ground of wrong-way drivers who all too often die, along with innocent victims, in the locale that gave them birth. An occasional one is found on a conventional road, but the vast bulk begin and end their illegal trips on the freeway.

Warning messages, traffic islands, directional arrow signs and pavement markings all combined can fail to penetrate an alcohol-soddened brain, the mind of a person suffering a mental

At on-ramps, a white-on-green sign reading "FREEWAY ENTRANCE" will be placed at the point of entry.

defect, or even the reveries of a daydreamer. The result? Another vehicle rolling head-on into the opposing flow of traffic.

Reports from the California Highway Patrol regarding 388 specific wrong-way drivers apprehended on freeways revealed that the circumstances through which 88 of them become traffic offenders couldn't be determined. Of the remaining 300, 137 (45.6 percent) entered the freeway via an off-ramp. An even dozen (4 percent) made a U-turn from an off-ramp and thereby headed in the right direction once on the freeway, but 37 others (12.3 percent) completed U-turns on off-ramps that had them bucking traffic flow once they were back on the freeway.

The U-turn was also popular with 25 (8.3 percent) who made them into on-ramps; 9 (3 percent) who made "hard-to-classify" types involving ramps; and 67 (22.3 percent) who made them on the freeway's traffic lanes.

Thirteen rugged individualists (4.3 percent) simply drove across the median divider to become wrong-way drivers under other circumstances.

Drinking drivers are far more prone to originate their wrong-way trip at an off-ramp than are those who are sober. The unintoxicated make U-turns to head the wrong way as often as they enter traffic by means of an off-ramp.

Not Easy to Get Facts

The engineers who design freeways could benefit immeasurably in their attempts to build more nearly foolproof interchanges if definite information could be developed regarding the type of off-ramp most commonly used by wrong-way drivers. If the geometric features or combinations of

TOP TWENTY COUNTIES

All Incidents

	Total incidents*	1964 Fwy. travel (MVM)†	Percent entered via off-ramp	Percent over 70 age	Percent H.B.D.‡
1. San Bernardino	133	972	36.1	16.5	27.9
2. Los Angeles	132	8,236	32.6	6.0	42.5
3. Riverside	114	480	20.2	17.5	21.9
4. Tulare	55	305	14.5	12.7	40.0
5. Ventura	54	238	16.7	13.0	29.6
6. Solano	52	282	25.0	7.7	40.4
7. Santa Barbara	51	200	11.7	3.9	25.5
8. Santa Clara	39	665	18.0	18.0	28.2
9. Sacramento	38	494	60.5	10.5	63.2
10. Contra Costa	38	535	39.5	10.5	55.2
11. San Diego	35	1,102	48.5	8.6	54.3
12. Kern	34	300	11.8	5.9	26.5
13. San Luis Obispo	33	118	18.2	27.2	18.2
14. Fresno	32	202	31.2	6.3	40.6
15. Alameda	32	1,503	21.9	18.7	43.8
16. Sonoma	30	197	30.0	13.3	53.3
17. Monterey	27	78	0	25.9	14.8
18. San Mateo	26	926	42.3	0	73.0
19. Merced	24	87	16.7	8.3	37.5
20. Orange	23	999	34.8	8.7	34.8
Average			27.0	11.9	36.2

* Includes freeway, expressway and conventional roads of both incident studies.
† Millions of vehicle-miles.
‡ H.B.D. = Had been drinking.

same that are conducive to illegal entry could be identified, then steps could be taken to modify those in existence at present and revise construction design in the future.

For these reasons, intensive efforts were made to learn the point of origin of each wrong-way trip. But it was a difficult task, for many of the older drivers and those who had been drinking had no idea as to where they had gone astray, let alone why. Even when they could locate the interchange they had used to enter the freeway, there were alternate paths they might have followed.

This confusion is not difficult to understand, for even sober, normally alert drivers who offended must have been in something of a mental fog or they would not have been apprehended unknowingly headed in the wrong direction.

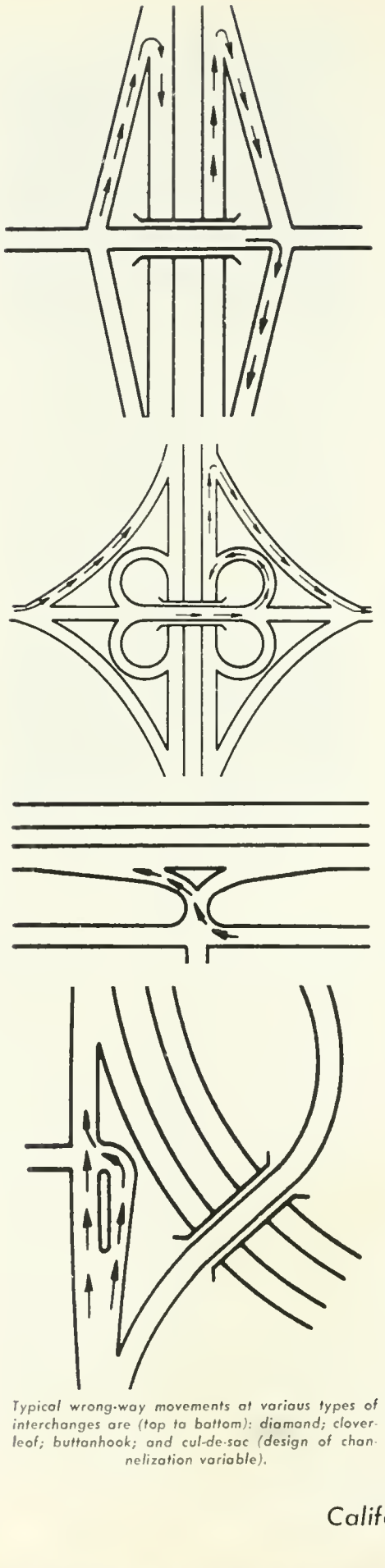
Only when the arresting officer actually witnessed the entry was an exact determination made of the origin of the incident. Sometimes geography and geometry combined to identify a particular ramp. In other cases, a researcher was able to pinpoint a ramp as the highly probable location. When sufficient clues were not available, the point of entry was classified as "unknown."

Intentional wrong-way driving was confined mostly to taking shortcuts. A typical example is the driver who misses the off-ramp at an interchange and then makes a U-turn into the on-ramp to reach his desired connection.

Both Urban and Rural Freeways

Offenders were found on both high-traffic-volume urban freeways and on low-volume rural freeways and expressways. In the urban setting, a driver can usually see that he is doing something wrong simply by observing other vehicles. However, he is often unable to take corrective action because of heavy traffic and because median barriers thwart his desire to cross over to the side where traffic is flowing in his direction.

Out in the country, large gaps in the traffic flow make it easy for wrong-way entries and provide fewer clues by moving vehicles as to the correct direction in which to travel; but far greater opportunities exist for corrective measures on the part of the offending driver once he realizes his mistake.



Typical wrong-way movements at various types of interchanges are (top to bottom): diamond; cloverleaf; buttonhook; and cul-de-sac (design of channelization variable).

The report contains a chart that shows the number of wrong-way driving incidents by counties. Also listed is the number of freeway vehicle-miles traveled per year; the percentage of offenders who entered freeways from off-ramps; the number of offenders over 70 years of age; and the percentage that had been drinking.

Because almost one-third of the mileage driven on freeways occurs in Los Angeles County, it would seem safe to assume that most wrong-way drivers would be apprehended there—but it isn't so. Neighboring San Bernardino County, with its long stretches of desert as well as urban freeways, holds that dubious distinction with 133 incidents, although Los Angeles comes in a close second with 132. Riverside is third, but Tulare County—which is almost entirely rural and has considerably less travel than highly urbanized Contra Costa, Alameda, or San Mateo Counties—ranks fourth on the list and has considerably more wrong-way driving incidents than the latter three counties.

San Luis Obispo County, which ranked 13th in overall standings, led the top 20 in elderly offenders with 27.2 percent. San Mateo County ranked 18th, but led the top 20 in drivers who had been drinking with 73 percent.

Sacramento County, in ninth place overall, was first with 60.5 percent in the "entered via off-ramp" category and second in percentage of "had been drinking" cases, 63.2 percent.

Corrective Signing

A traffic sign can save your life, but it is only a worthless piece of metal cluttering the side of the highway when drivers fail to read and heed it.

Those who don't bother about signs are lucky if they live to regret it, for some signs provide the instructions necessary to keep persons from becoming wrong-way drivers on freeways.

That fact was borne out in experiments conducted by the Driving Simulation Laboratory, Institute of Trans-

SOBRIETY BY AGE GROUPS

All Incidents

Age group	Drunk or ability impaired		All groups of H.B.D.*		Sober		Percent of group that H.B.D.*
	Number	Percent	Number	Percent	Number	Percent	
16–29	31	12.7	65	15.2	122	16.4	34.6
30–39	77	31.6	133	31.0	93	12.5	58.9
40–49	72	29.5	118	27.6	119	16.0	49.8
50–59	50	20.5	82	19.2	128	17.3	39.1
60–69	11	4.5	22	5.1	151	20.4	12.7
70 and over	3	1.2	8	1.9	129	17.4	5.8
	244	100	428	100	742	100	36.7
Not stated	9		16		28		
	253		444		770		

* H.B.D. = Had been drinking.

portation and Traffic Engineering at the University of California, Los Angeles and the California Division of Highways.

First, the laboratory tested different words and color combinations and discovered that white letters on red background are quick to draw attention.

Once the colors were decided upon, highway engineers started work to discover the message that would best get through to potential wrong-way drivers. Three signs were developed for testing. All were five feet high and three feet wide. On one the message read "WRONG - WAY – GO BACK"; the second said, "STOP–GO BACK"; and the third, "GO BACK – YOU ARE GOING – WRONG WAY."

The signs, augmented by a five-foot-long white-on-red sign reading "DANGER," were installed at an on-ramp in Sacramento. Then 18 unsuspecting drivers were asked to follow an itinerary that included that particular on-ramp.

Four of the drivers didn't notice the signs. Five saw them but failed to react. The remaining nine not only saw the signs but slowed down and then stopped.

As a partial explanation as to why some drivers didn't see (or heed) a sign that obviously warned of danger ahead, traffic engineers point out that the signs were purposely placed on the driver's right at a place where normally they should focus their attention to the left because they should be preparing to merge into freeway traffic.

Phrase 'Wrong Way' Best Understood

Interviews with the 18 drivers plus a myriad of other facts resulted in the conclusion that the phrase "WRONG-WAY" was the best understood and that the sign, "GO BACK – YOU ARE GOING – WRONG WAY" best indicated what was wrong and the proper corrective action that should be taken. This sign, therefore, will be further tested in one geographic area to see if it adds further benefits to those that will be derived from the following statewide sign installations now in progress:

1. The black-on-white "DO NOT ENTER" signs now in place at off-ramps will be augmented with an accompanying "WRONG-WAY" white-on-red sign. This sign is the result of joint findings by ITTE and the Division of Highways.

2. White arrows now painted on pavements at all off-ramps have been redesigned and lengthened so they appear as arrows—not only to the persons following them—but to wrong-way drivers as well. The present arrows are not easily identified as directional markings by wrong-way drivers. This refinement is another result of ITTE and Division of Highways joint efforts.

3. At on-ramps, a white-on-green sign reading "FREEWAY ENTRANCE" will be emplaced at the point of entry. The color green suggests "go conditions" and complements the red "no-go situation" at exit points of off-ramps. Once again, ITTE experts and Division of Highways engineers cooperated in developing this sign.

4. At transitions from undivided sections to freeways, the 24-inch by 30-inch "KEEP RIGHT" signs will be replaced with 48-inch by 72-inch ones where median widths permit. In advance of this sign, another will be installed that reads "DIVIDED ROAD" and 100 feet past the "KEEP RIGHT" message will be still another that reads "DO NOT ENTER." This message will be in 12-inch black letters on a white background and will be supplemented with another white-on-red reading "WRONG-WAY." White arrows of the new design will be painted at 100-foot intervals in each lane and in both directions of travel. This system was designed by the Division of Highways.

5. At all transitions from freeways to expressways, the first median crossover or intersection at road level will be safeguarded by "DO NOT ENTER" signs visible only to drivers proceeding in the wrong direction. The new pavement arrows will also be installed at road level intersections on expressways. Once again, this is a Division of Highways project.

State highway engineers and psychologists of the ITTE staff agree the signs should have a great favorable impact on the wrong-way driving rate in California.

The State Highway Commission has allocated $500,000 for the entire project and the signs will be installed at more than 5,000 locations by the year's end.

Spike Barrier

Like that old show business complaint about everybody wanting to get into the act, just mention the wrong-way driver problem to some people and they sit down, write a letter to their favorite state official and tell him the answer.

All the letters end up with the California Division of Highways, and a handful each day (about 90 percent) laud the abilities of the spike barrier. The writers are understandably anxious to keep wrong-way vehicles from entering the freeway, but they seldom consider the ramifications of this "solution." Traffic officials shudder at the thought of an immobilized vehicle facing fast-moving right-way traffic on a freeway off-ramp and backing traffic up on the freeway lanes themselves.

Spike barriers seem to be the ideal solution for a commercial parking lot operator who has a problem in keeping his customers headed in the right direction—but they could create mass havoc if installed at freeway ramps.

For the past several years, the California Division of Highways has been seeking a physical barrier that would keep vehicles from entering freeways via off-ramps and departing them from on-ramps. Their success in parking lot operations concerned made it inevitable that the search would one day turn to spike barriers.

Effectiveness Tested

The barrier tests were designed to determine just how effective the spikes would be in disabling all types of wrong-way vehicles; whether they would cause drivers to lose control of their vehicle; and if they would stand up under heavy freeway traffic.

Only simple binding tests were needed to determine that metals used in spikes now being manufactured could not stand the constant pounding of heavy traffic.

This, however, was a problem that could possibly be overcome by making spikes from tougher metals (if other aspects made it worth while), so traffic engineers, technicians from the Division of Highways Materials and Research Laboratory, and test drivers moved to an outdoor driving range to check the spikes' abilities in disabling an automobile and to see what would happen to a driver when he suddenly found himself rolling along on from one to four punctured tires.

A compact foreign car and a standard American-built passenger auto used in the experiments were driven in a series of passes over the barrier at speeds varying from 15 to 60 miles per hour. They were equipped with four-ply and two-ply tubeless tires. Cars were driven both the right way and the wrong way across the spikes.

From the outset the compact car proved that a narrow tire could beat the barrier a substantial part of the time by crossing between spikes. And both the compact and the standard-size auto suffered no immediate appreciable damage when spikes penetrated their tires.

Complete Failure in One Series

In one series of seven runs where punctures were encountered, the barriers were miserable failures. On six runs the driver wasn't able to detect a loss of air pressure from affected tires within 5 minutes. On the other occasion, the driver realized he had a tire going flat after only 10 seconds —but at 60 miles per hour, 10 seconds is the equivalent of 880 feet of travel.

Still not convinced they weren't on the right track, the engineers designed fish hook barbs big enough to hold a fair-sized shark and replaced the blunt ends of spikes with them. The barbs did just exactly as hoped—they ripped chunks of rubber and fabric from the tires—but it still took a minimum of 10 seconds before a damaged tire deflated and quite often 30 seconds went by before the flat occurred.

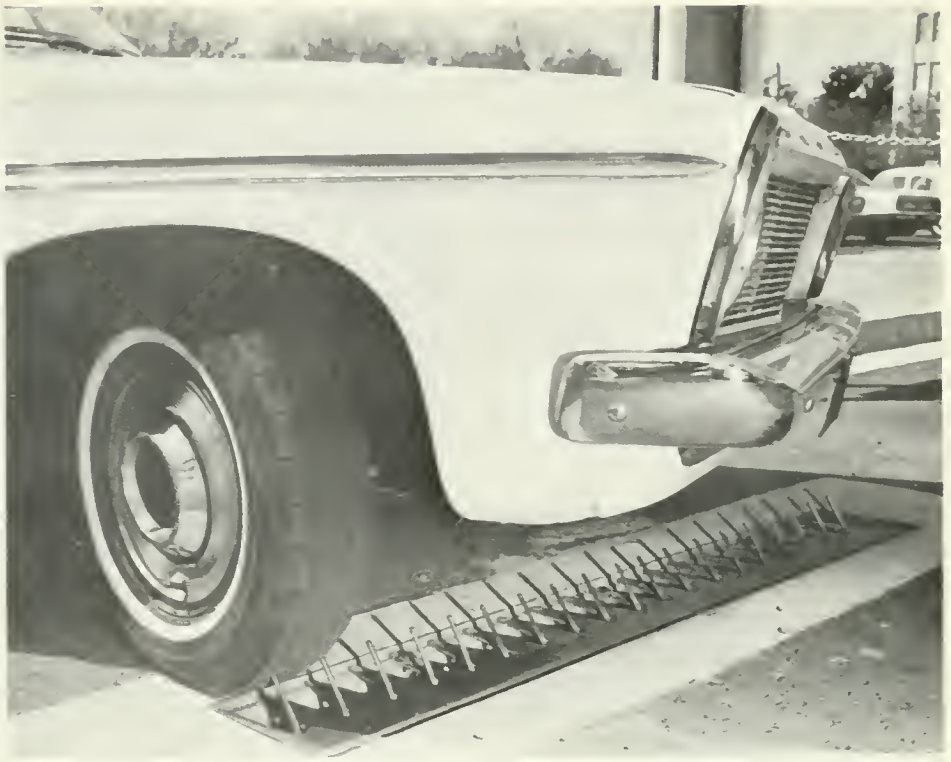
The barbs proved to have an unhappy side effect, too. The momentum of car and the strength of the tire combined with the gripping power of the barbed spike caused a permanent deformation of the spike so as to point the spike straight up. In this position, it would damage right-way as well as wrong-way vehicles.

Not one test run resulted in the driver losing control or the vehicle

Redesigned pavement arrows will be painted at 100-foot intervals in each lane and in both directions of travel.

showing a tendency to roll. But the engineers refuse to rule out either factor.

They point out that in the interests of safety, no tests were made of vehicles equipped with worn tires or tube-type tires that lack the facility to at least partly seal themselves. Nor were runs made in excess of 60 miles per hour. Instead, they were content to stop after making certain that the spike barrier could not be incorporated into the freeway system without creating hazardous conditions that would threaten the safety of inexperienced drivers.



Although spike barriers seem an ideal solution to the wrong-way driving problem, tests show that they would only create havoc if installed at freeway ramps.

Bids Invited on Big Interstate Projects

The State Division of Highways called for bids early in June on three projects involving multimillion-dollar construction on two interstate highways in San Mateo, Stanislaus, and San Joaquin Counties.

The San Mateo County project involves grading and paving to construct 3.4 miles of the eight-lane Interstate 280 Freeway, between a half-mile south of Arroyo Drive in South San Francisco and Eastmoor Avenue in Daly City.

Interchanges will be constructed at Westborough Boulevard, the future Hickey Boulevard Extension, at Collins Avenue, and the future Route 1 Freeway. Undercrossings will be provided at King Drive, Hickey Boulevard, Collins Avenue and the Chinese Cemetery Road; and an overcrossing at the Sullivan Avenue ramp.

Bids will be opened July 28 in Sacramento. Approximately $10,425,000 is available for the project.

At its northerly limits this project will connect to a 2.6-mile segment of Interstate 280 freeway construction currently in progress between Eastmoor Avenue in Daly City and Orizaba Avenue in San Francisco, which is scheduled for completion in late summer of 1966.

The Stanislaus County project consists of grading and paving to construct 9.2 miles of four-lane Interstate Route 5 (Westside) Freeway between 0.4 mile north of Stuhr Road and 0.7 mile south of Del Puerro Canyon Road.

An interchange will be constructed at Fink Road, undercrossings at Covell, Oak Flat, and Niels-Hansen Roads, and overcrossings at Simon-Newman and Davis Roads. Bridges will be provided across the California Aqueduct and Crow and Salado Creeks.

Bids will be opened July 21 in Sacramento. Approximately $4,667,900 is available for the project, including an estimated $397,900 to be paid by the Department of Water Resources.

Construction is just beginning on jobs at either end of this 9.2-mile project. On the north, a 13.1-mile segment extends from 0.9 mile south of Del Puerto Canyon Road to the San Joaquin county line. On the south, a 13.8-mile segment begins 0.4 mile north of Stuhr Road and extends to 2.8 miles north of Route 33 in Merced County.

The project in San Joaquin County calls for constructing twin two-lane parallel bridges on Interstate 5 (Westside) Freeway across the California Aqueduct, two miles north of the Stanislaus county line, about 12 miles southeast of Tracy. Bids will be opened July 7 in Sacramento. Approximately $338,400 is available for the project, including an estimated $148,400 to be paid by the Department of Water Resources.

Another San Joaquin County project provides for grading and paving road approaches and ramps, and grading for just over two miles of four-lane freeway, as the first stage of extending Route 132 westerly from its present terminus in Vernalis, to connect with the Interstate 580 (Westside) Freeway construction now in progress and scheduled for completion late this year.

This first stage includes construction of twin bridges across the California Aqueduct and an interchange with Chrisman Road. The project extends slightly more than a mile, beginning just east of Interstate 580. It is anticipated that the second completing stage will be advertised later this year.

Bid opening was to be June 30. Approximately $3,550,000 is available for the total project, including an estimated $190,000 to be paid by the Department of Water Resources.

District 3 Wins 6th Top Award in 7 Years

The Marysville Division of Highways District has again received the California Division of Highways statewide first place award for safety achievement, the sixth time in seven years.

The award for 1964 was presented during ceremonies in Sacramento by Deputy State Highway Engineer George Langsner.

W. L. Warren, district engineer, accepted the certificate of achievement on behalf of the district.

The citation is given annually to the 1 of 11 state highway districts which has the lowest number of hours lost from work as a result of on the job injuries. In 1963 the Marysville District tied for top honors with District 10, Stockton.

In addition, the Marysville office has won two plaques in recognition of over one million continuous working hours without a lost-time accident.

In the history of this Highway Division only three such awards have been made.

Since the inauguration of the district's safety program in 1952 lost-time accidents have been decreased from 49.60 per million man hours to 2.27 accidents per million hours.

There are 1,400 employees in District 3 with work assignments in 11 Sacramento Valley and Sierra mountain counties.

More than 1,000 pieces of automotive and maintenance equipment are in use by the districts including 400 units assigned to the snow belt to help keep highways open.

Don Wieman Retires In San Bernardino

Don S. Wieman, highway superintendent with District 8 in San Bernardino, retired last month (May) after a 34-year career with the Division of Highways.

Wieman's career—which dates back to September 1931, when he started working for District 8—advanced through positions as stone mason, construction foreman, maintenance foreman and superintendent to superintendent of districtwide crews.

Wieman grew up on a small fruit farm in San Joaquin Valley. His background includes working as a building contractor and a millwright in an oil tool shop.

Scenic Highways Committee Inspects I-280 Model

Members of the Advisory Committee on a Master Plan for Scenic Highways, currently engaged in compiling a set of scenic highway standards intended for state and local use in accordance with 1964 legislation, devoted part of their agenda at a recent meeting to studying a Division of Highways scale model of a scenic treatment of Interstate 280 in San Mateo County.

Committee members and others grouped around the model are (clockwise): Charles Perry Walker, City Councilman and former Mayor of Manhattan Beach; Richard Leonard, San Francisco attorney and conservationist; Bridge Planning Engineer A. L. Elliott, Division of Highways; Edwin S. Moore, San Francisco, executive vice president of the California State Automobile Association; Robert Grunwald of Hanford, city and regional planning consultant; Harry P. Schmidt of Gustine, Merced County Supervisor and chairman of the advisory committee; Assistant State Highway Engineer G. A. Hill; Dee W. McKenzie, chief of the highways and bridges division of the Sacramento County Department of Public Works; and State Deputy Director of Public Works Harry D. Freeman. Not present for the picture was Committee Member Nathaniel Owings of Big Sur, noted architect.

The committee has been meeting monthly since February 1964, in conjunction with state personnel engaged in planning and highway design.

San Diego-Coronado Bridge Test Borings Started

Work has begun on foundation borings—the first contract to be awarded by the State Division of Bay Toll Crossings in connection with the San Diego-Coronado Bridge.

The J. N. Pitcher Co. of San Francisco will take 465 soil samples during the coming month from the land approaches on either side and from beneath the waters of San Diego Bay. The company has been awarded a contract for $34,580 to do the work.

A portable rotary drill will be used and will work from a barge for the overwater borings.

The 465 soil samples to a 300-foot depth will be taken from approximately 15 test holes at intervals along the route of the bridge, which will cross the bay via a curving arc from San Diego to Coronado.

The bridge is scheduled to be completed in 1969.

The bridge will be 10,000 feet long and will provide 200 feet of overwater clearance--ample for the largest naval and commercial vessels.

There will be three main spans. Two will cross parallel 600-foot channels for ship traffic and a third will span a 500-foot channel near the San Diego bulkhead line. This additional feature was requested by San Diego port authorities.

The bridge will carry four lanes of traffic on a single level and will provide maximum traffic benefits by linking Route 5 near Crosby Street in San Diego with Glorietta and Fourth in Coronado. It will carry traffic from Coronado directly into the San Diego freeway system.

Construction will cost over $30 million and will be financed by bonds which will be retired by a basic 50-cent automobile toll, with graduated tolls for other vehicle types.

Mission Gorge Road

6 Miles of Key Highway Constructed in San Diego

November 20, 1964, marked the completion of construction of Mission Gorge Road. The area where this project is located has long been considered of historical significance as the Padre Dam, the source of water for the first San Diego Mission. This federal aid urban extension project was a joint San Diego County, San Diego City, State of California and Bureau of Public Roads effort. Studies prepared under the direction of D. K. Speer, county surveyor and road commissioner, had for some time indicated that relief for the Carlton Hills, Santee, Lakeside and east county traffic was in order. During commuter hours, traffic had been extremely congested and hazardous on the old meandering two-lane highway.

Several materials and asphalt plants contributed truck traffic to aggravate the situation further. Public traffic can now flow smoothly and safely at the 65-mile-per-hour design speed on multilane construction. Three miles of the existing alignment was improved, with 2.6 miles of the northeasterly end being entirely new construction, for a total of 5.6 miles. The project beginning is in the City of San Diego at Zion Street and terminates at Simeon Drive in the County of San Diego. Two and two-tenths miles of the alignment is in the City of San Diego and 3.4 miles in the county.

Preliminary Design

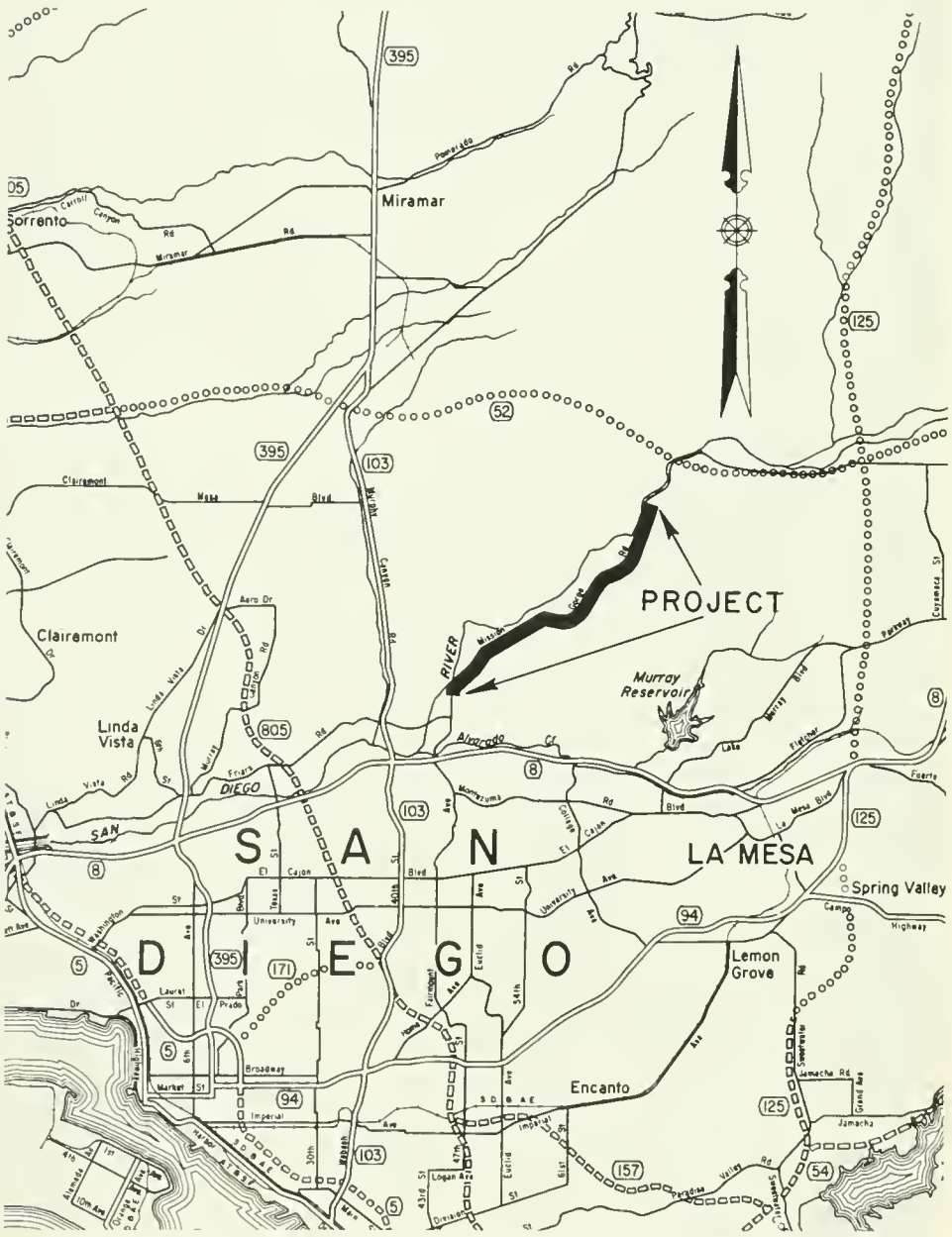
Preliminary design work made full use of aerial photography methods in alternate route comparison, final alignment placement and plotting of elevations used in earthwork calculations. Earthwork computations were performed by the data-processing section of the California Division of Highways using punched cards and magnetic tape data-processing equipment.

Drainage appurtenances include reinforced concrete culvert pipe, precast and cast-in-place concrete drop inlets and both lined and unlined ditches. All ditch lining was air-blown mortar.

Federal aid urban funds provided for 50 percent of the financing of the project, with the remaining 50 percent shared by the County of San Diego and the City of San Diego.

Design

Geometric design was based on an average daily traffic in 1981 of 11,000 cars with a design speed of 65 miles per hour. Minimum curve radius is



The project, which begins at Zion Street in the City of San Diego and terminates at Simeon Drive in the county, involved widening and realignment of the roadway.

This oeriol looking northeost shows the reolignment. Part of the old rood con be seen in the upper left corner of photo. The old rood will be retoined for occess into o proposed city park.

950 feet and maximum gradient is 7 percent. Typical cross-section of the road is four-lane divided either by an 18-foot unpaved median or a 4-foot raised and paved island. The shoulder area will be eight feet paved on the right and two feet paved on the left. The maximum uphill grades have an added lane for slower moving traffic.

The structural section consists of one foot of subbase, an eight-inch base and three inches of asphalt concrete. Subbase was deleted through rock cut areas.

Contractor

The contract was awarded on December 12, 1963, to C. W. McGrath, Inc., of San Diego. The contract allowed 350 working days to complete the contract, the contractor actually used 223 working days, attesting to excellent progress. The final construction cost exclusive of engineering was $1,779,000.

Construction

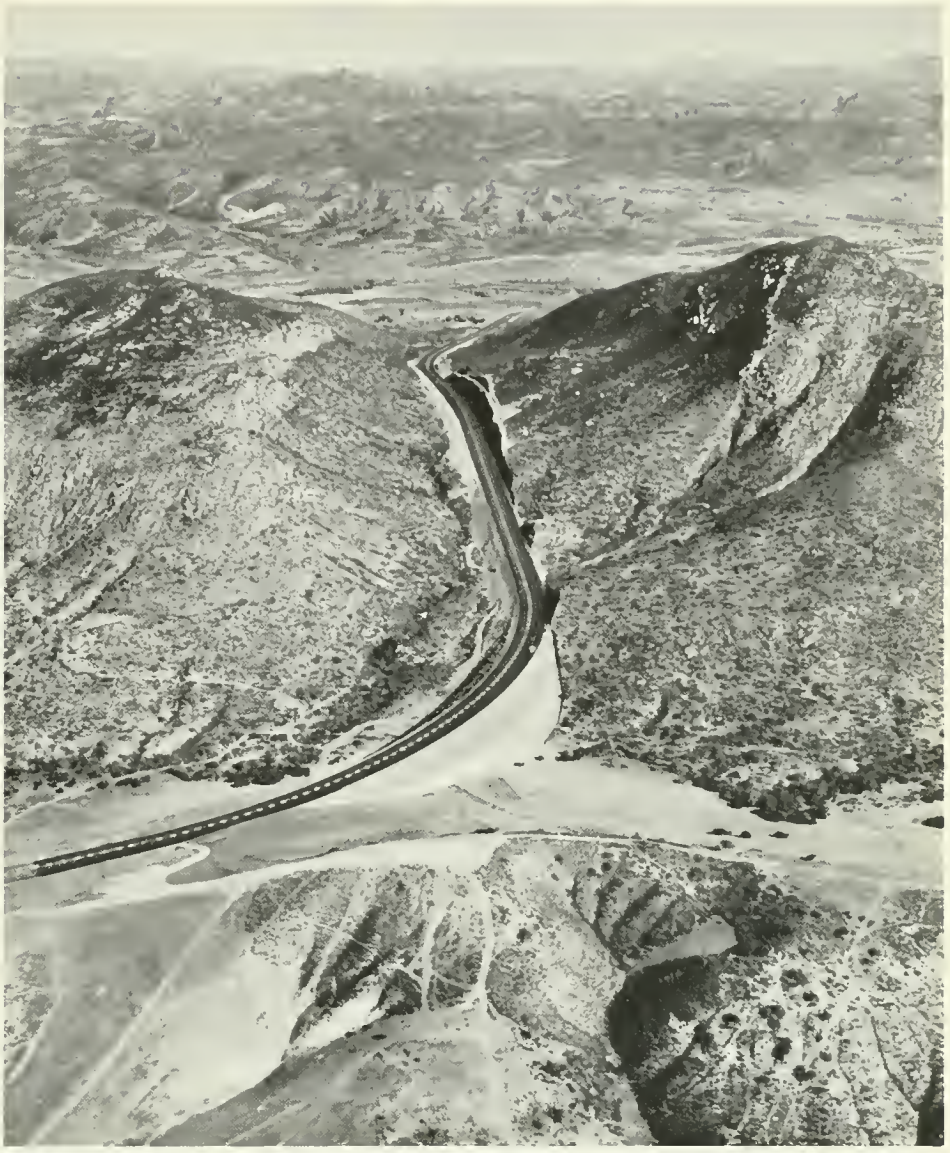
Generally, the contractor used conventional methods to complete the work. One of the major items of work was the moving of slightly in excess of one million cubic yards of roadway excavation, of which an estimated 250,000 cubic yards consisted of rock, concentrated mainly in a large 84-foot cut at the north end of the project. South of this deep cut is an 85-foot-high embankment containing approximately 325,000 cubic yards. The rock excavation was variable as to type, blue granite and disintegrated granite, intermixed, with many seams, which made it difficult to analyze for drilling and blasting.

First Use

One of the first uses in southern California of compressible backfill material over a reinforced concrete pipe culvert took place on this job. This consisted of a layer of baled straw placed over a 424-foot 78-inch reinforced concrete pipe to be covered by approximately 85 feet of embankment.

Soils

Site and soils investigation was handled by the County of San Diego, Surveyor Department Soils Laboratory. Extensive soil core borings and seismic studies of possible rock formations within the right-of-way were used to compile a comprehensive materials report.



An aeriol looking northword showing the 84-foot rock cut and the 85-foot embonkment involved in the highwoy reconstruction.

The materials report was made available to prospective bidders in hope of obtaining more realistic earthwork prices and it is believed the report did influence the construction costs.

An evaluation of seismic data of the materials report during construction indicated the results were accurate within practical limits. The materials report was reviewed by District 11 California Division of Highways Materials Laboratory under the direction of Paul Ruplinger.

Personnel

Project design was under the immediate supervision of Alton S. Hamm of the County of San Diego. He and the writer were the resident engineers. State project construction representative was James V. Bell.

The City of San Diego furnished some of the inspectors for the project. The inspection force used handie-talkie citizen band radios to communicate on the site. Jack Crabtree and Ray Johnson acted as superintendents for the contractor.

Route 44 Expressway

By FRANK P. BERNARD, Resident Engineer

he latter were coupled as reversing urves. A climbing lane was added uring construction to relieve truck raffic at the one location with maxiium grade.

Concrete girder bridges 40 feet ide provide unobstructed shoulder idth across both Stillwater and Clough Creeks. Stanley D. Newell nd Robert Tucker were bridge representatives on this work.

Unusual Protective Treatment

Unusual protective treatment was ecessary at the four reinforced con rete box culverts constructed on this roject. Protective coatings of coal ar primer followed by coal tar enamel were applied to concrete surfaces in ontact with earth to prevent acidic leterioration. Polyethylene sheeting was placed beneath invert slabs, and oal tar primer only was utilized on nterior surfaces. Corrugated metal ulvert pipes were bituminous coated with paved inverts through these reas. For the last half of this project, ncoated concrete pipe culverts were atisfactory because of less acidic soils.

The old highway was extremely circuitous, had rolling ground level grades, and was structurally inadequate for present-day traffic. The Shasta County improvements of the early 1920's were undoubtedly more than adequate for that era, however, the numerous 20–30-mph curves and two 16-foot-wide bridges constructed at that time have long since been outmoded. Normal traffic growth, coupled with rapid residential expansion both adjacent to and beyond the existing facility, hastened its demise as the principal traffic artery. However, the existing 20-foot-wide roadway and one-way bridges at Stillwater and Clough Creeks should be adequate to handle local traffic for many years to come.

Second Section Completed

The second section, between Cow Creek and 0.9 mile east of Millville, was completed on November 17, 1964, by Ransome Company and Hughes and Ladd. This two-lane expressway has 70-mph design speed, a 40-foot typical section, and maximum grade of 1.05 percent. The grade line is generally well above the original ground, thereby providing headroom for

A typical hazardous curve on the old highway

A typical curve and one-way bridge at Clough Creek on the old highway

drainage facilities and avoiding water problems associated with the flat terrain. The new alignment utilizes three 2,000-foot-radius curves, as compared to 24 substandard curves on the existing facility.

The excellence of this location is emphasized by the elimination of two curves, shortening the route by nearly one mile and the elimination of several major drainage structures. A single 444-foot concrete girder bridge now spans Cow Creek in lieu of five bridges on the old alignment. This was accomplished by positioning the new alignment to cross Cow Creek below the confluence of its several tributaries. William H. Schessler was the bridge representative on this work.

The original highway was narrow and had numerous overcrossings, reversing curves in addition to three right-angle turns. The grade line was relatively flat, and closely paralleled

the natural ground. This condition aggravates the deficient structural section due to proximity of moisture. New concrete bridges and approaches have been constructed at Oak Run Creek, Clover Creek, and South Cow Creek in recent years, but little else has been changed since the early 1920's. The steam tractors, pictured in this article, used this route around the turn of the century. Two-wheel trailers, coupled in series and hauling 16-foot lengths of rough-sawn lumber, were towed by these tractors between Shingletown and the railhead at Bella Vista. According to old timers the biggest traffic problem was to hold onto the team while these "new-fangled contraptions" passed by. Anyone traveling Highway 44 between Shingletown and Viola can see one of these steam tractors at the Big Wheels Resort.

A steam tractor used at the turn of the century to tow trailers transporting lumber from Shingletown to the railhead at Bella Vista.

Route History

The exploration and development of the western territory is closely tied into the country traversed by these projects. The Old Oregon Trail runs northward near the beginning (see sketch). Less known, perhaps, is the "Walla Walla Trail" established by Alexander McLeod in 1829. At that time Hudson Bay Company sent McLeod south to explore the Sacramento Valley. His travels took him via the present town of McCloud, down the Pit River, and along the Cow Creek Basin to its confluence with the Sacramento River. Joseph Chiles, who established the "Yellowstone Cutoff" between Boise and Fall River Mills, used this route in 1843. John Fremont's northward travels in 1846 proceeded via the Millville Plains and continued along this trail. It is interesting to note that of all the United States territories, northern California was the last challenge to these pathfinders. One pioneer said, "It was too far away and too difficult of access."

A 1.5-mile section of Route 44 at its western end is currently under construction in conjunction with Interstate Route 5 east of Redding. The intervening link, Interstate Route 5 to the beginning of the projects discussed in this article, is next scheduled for construction, with projects east of Millville to follow.

Even though these projects are only the beginning of planned improvements, the motorist will benefit by the added safety, increased comfort, and the knowledge that additional expressways are forthcoming. The day is not too distant when travelers to Lassen National Park and points beyond will enjoy the full blessings of a modern highway on Route 44.

The new Route 44 expressway looking toward the intersection with Deschutes Road.

NEW AMERICAN RIVER BRIDGE

The State Department of Public Works has announced the award of a $1,550,677 contract for constructing a four-lane bridge with sidewalk and horse trail across the American River in Sacramento County southwest of Folsom. Upon completion of the bridge, the county plans to complete construction of Hazel Avenue from Nimbus Interchange to Madison Avenue.

Senate Resolution Orders Fog Study; Fog Abstains

WITHOUT

WITH

Senate Resolution No. 33 ordered a fog study, but it didn't order the fog —at least not thick enough for study purposes. This may have been fine with California motorists, but it threw a curve to the Highway Transportation Agency, which was to report its findings and recommendations to the Legislature before March 15, 1965.

Since the beginning of the SR 33 study there have been very few days with ground fog sufficiently dense to reduce visibility below a sight-distance of 500 feet—the environment in which most multiple vehicle accidents occur, according to traffic engineers.

Submitting an interim report, Agency Administrator Robert B. Bradford has recommended continuation of the study for another year.

The resolution, introduced at the 1963 regular session of the Legislature by the late Senator L. M. Backstrand of Riverside and Senator Randolph Collier of Yreka, requested a study to determine possible means of giving advance warning to drivers of the need for greater alertness and caution during periods of reduced visibility, and to explore the use of warning devices or other means to inform drivers of existing hazardous conditions.

Although the number of fog accidents involving more than four vehicles comprise less than 0.2 percent of all accidents on the state highway system, the number of these accidents has fluctuated widely from year to year, seemingly in relation to the number of "foggy" days.

Testing methods being used in the study involve four general categories: roadway and signing, patrol activity, public information, and vehicle equipment.

Roadway and signing devices being tested include illuminated variable speed limit signs, shoulder striping, colored edge and gore striping at off-ramps, and raised lane markers and other warning devices.

Along with increased patrol activity, it is proposed to use the rear amber flashing lamps both on moving patrol cars, and patrol units parked off the roadway.

Public information testing will consist of broadcasting advisory warnings to motorists over AM radio.

As to vehicles and equipment, the study group is determining the best means of rear lighting to enable motorists to signal that their vehicle is proceeding normally, is rapidly slowing down and stopping, *is* stopped, or is about to change direction.

Except for partial testing of the variable speed limit signs, virtually no testing of other devices has been possible because of lack of ground fog at test sites. Tentative results indicate that with low to moderate traffic volume in daylight fog conditions, motorists voluntarily reduce their speeds by about five miles per hour, and that the illuminated speed limit signs cause an additional 5-mph reduction. But these speeds were still generally higher than those considered safe with the limited visibility. The posted speeds did, however, produce more uniform speeds, and also reduced the number of short headways, or tailgating.

Plans for the continued year of study, if the Legislature extends the time limit, are to determine the effect of posted illuminated speed limits under high-volume traffic and nighttime conditions, as well as the effectiveness of devices and methods already under consideration.

September Date Set For Highway Week

The 1965 observance of National Highway Week will take place during the week beginning September 19.

In California the observance will again be a cooperative affair involving various highway-oriented organizations and the State Division of Highways. Its purpose will be to focus public attention on the progress being made and the problems involved in providing safe, adequate highway transportation throughout California.

Among the organizations most active in the event will be Californians for Modern Highways, Inc., the Automobile Club of Southern California, the California State Automobile Association, the California State Chamber of Commerce and various industrial groups.

As in recent years, the district offices of the Division of Highways will provide informational material and exhibits on regional and local highway development in cooperation with local highway organizations. Events such as highway "ribbon cuttings," groundbreaking for new projects, etc., are expected to be numerous.

Northern California regional chairman for National Highway Week is Sherman P. Duckel, retired chief administrative officer of the City and County of San Francisco. Duckel is a vice president of Californians for Modern Highways, Inc. A southern California regional chairman was to be designated later in June.

The American Association of State Highway Officials, through its subcommittee on public information, is coordinating plans for the observance nationwide.

The new stretch of eight-lane freeway on Route 24 looking toward the east portal of the Caldecott Tunnel. Gateway Boulevard interchange is in the foreground.

Bay Area Freeways

By ALAN S. HART
District Engineer

District 4, headquartered in San Francisco and responsible for the administration of more than 1,600 miles of state highway in the nine bay area counties, reports substantial progress during the past year, with major emphasis on completion of the federal system of interstate and defense highways.

There are a total of 192 miles within the district, and almost 76 miles of these interstate system routes have been completed to date. More than $90,000,000 is currently allocated towards going construction or budgeted projects which, when completed, will provide an additional 53 miles of modern interstate freeways.

Right-of-way costs already expended and budgeted for the interstate system amount to over $205,000,000. Plans are proceeding rapidly on the balance of the system, looking toward early construction on the remaining 63 miles of interstate highways in the bay area.

Tremendous Undertaking

While development of the interstate highway system in the bay area is a tremendous undertaking, it has become even more of a challenge to the district and its staff with the approval by federal authorities on October 12, 1964 for a new routing for Interstate 680 in Santa Clara and southern Alameda Counties. This new interstate route, extending for about 15 miles between Interstate 280 in San Jose and Warm Springs, supersedes the previously approved routing along the already constructed Nimitz Freeway through San Jose and north to Fremont. It will provide a new parallel corridor for traffic around central San Jose and the easterly side of the Santa Clara Valley.

Designation of this new route as an interstate highway to be completed by 1972 will mean that plans must be prepared and right-of-way acquired over a very short period of time for construction estimated to cost about $56,000,000 and right-of-way acquisition estimated at $50,000,000.

Seeks Satisfactory Plan

In San Francisco the district has been seeking to provide a satisfactory freeway plan to meet the increasing need to relieve traffic congestion. San Francisco, because of its intensive development and exceptional character, provides a real challenge to engineers, planners, and architects working as a team. The designated interstate system includes 21 miles within the limits of the City and County of San Francisco. This limited mileage is expected to accommodate one-third (33 percent) of all vehicular traffic in the city upon its completion.

The interstate system provides a loop around San Francisco Bay, but also includes an inner loop in San Francisco connecting the three exterior corridors—Golden Gate Bridge, San Francisco-Oakland Bay Bridge, and the peninsula—with the heavy

Seattle Public Library
JUL 6 1965

traffic generators of the financial, commercial, and residential areas of San Francisco. To accomplish this in a manner fully compatible with the fabric of "the city" and in an appropriate scale with the surroundings, at a reasonable cost, has been the goal of city officials, consultants employed by the state, and the staff of District 4 of the Division of Highways.

Plans Need Approval

To date, plans and routing for the so-called Panhandle Parkway and Park Presidio Freeway (Interstate 80–280) have been prepared and discussed. By a vote of 6 to 5 the board of supervisors rejected these plans last October, and the California Highway Commission declined to adopt a route against this opposition. While not adopting the route recommended by the State Highway Engineer, the commission also stated its policy that it would not approve a proposal to construct the freeway in a tunnel, referred to as the Crosstown Tunnel. Whatever the final outcome is for this needed freeway, the district is prepared to commence design and make an all-out effort to see that this freeway is constructed, in the event approval is given by the board of supervisors.

Interstate 480 (the "Golden Gate Freeway") connecting the Embarcadero Freeway and the Golden Gate Bridge has been the subject of a similar exhaustive study, culminating in a district public hearing on April 9, 1965. The California Highway Commission took this routing matter under consideration on April 28, 1965, but deferred further action for 60 days in view of routing studies being conducted by the board of supervisors.

Interstate 280, running down the peninsula between San Francisco and San Jose, is in various stages of design and construction. This route, located mainly in the rolling wooded foothills, is being developed in a sympathetic manner befitting its exceptional setting.

Many features of the design were described in an article in the September–October 1964 issue of *California Highways and Public Works*. The assistance of local officials and citizens working through the Peninsula Highway Policy Committee has enabled the District 4 staff to be closely in touch with local feeling and desires. This means of channeling local proposals and communicating Division of Highways design features and studies has been helpful in reaching a satisfactory solution to knotty design problems.

Interest in Aesthetics

In line with the generally expanded interest in aesthetics, many unusual features in location, roadway layout, structure design, and other facets of the freeway plan have been developed. The first major contract utilizing curved-edge box girder bridges developed particularly for this area is now in progress. Contour grading, special design of slopes to fit the natural terrain, and curvilinear alignments on independent levels of grade line will all combine to improve the appearance of this highway.

Just a few years more will complete Route 280 freeway and provide not only a major traffic relief to overcrowded 101 Freeway (Bayshore) but also a vastly improved scenic drive along a beautiful area close to the northern California metropolitan centers.

Reflectorized Buttons

An interesting highlight of the work on metropolitan freeways is the placing of reflectorized pavement markers now being undertaken within the bay area. Several contracts have been completed and others are presently underway for the installation of these pavement markers as a supplement to conventional traffic lane striping on existing freeways. Almost all the new freeway construction projects now being built in the bay area will incorporate the use of these buttons.

The use of these reflectorized raised buttons was approved following exhaustive studies of alternate means of providing a visible traffic stripe during the rainy weather. The reflectorized stripe previously used as standard lane markers, while of excellent visibility for dry weather both day and night, was almost completely lost on wet pavement.

The raised buttons not only provide improved visibility but also give an audible or physical warning if the vehicle strays out of its lane. This improvement in lane markings on heavily traveled freeways is almost as important as the median barriers which were developed a few years ago and are now accepted as standard design for major freeways.

Following is a county-by-county report on recent major developments in District 4:

ALAMEDA COUNTY

Interstate Route 580

Two contracts are currently underway on Interstate 580—one between Buell Street and Durant Avenue in Oakland and the other from Sybil Avenue to 173rd Avenue in San Leandro. The latter will be finished late in the spring of 1966, completing more than 15 miles of continuous eight-lane freeway between the San Francisco-Oakland Bay Bridge and Castro Valley Junction in Hayward. Six previous contracts were required to complete the 8½ miles presently in service on this route in Oakland and San Leandro.

The most recently completed contract, covering two miles of freeway between the easterly limits of Oakland near Durant Avenue and Sybil Avenue in San Leandro, was opened to traffic in July 1964.

The project between Buell and Durant was started in late 1962 and will be completed this fall. Approximately $12,000,000 was allotted for the construction of 4.5 miles of freeway adjoining Calaveras Avenue and portions of Mountain Boulevard. Freeway-to-freeway traffic service between Warren Boulevard Freeway (Route 13) and Interstate 580 will be provided by a directional interchange being constructed in the vicinity of Mills College. Access to the freeway for local traffic will be provided at Davenport, Kuhnle, Edwards, Keller

and 106th Avenues and at Golf Links Road. Four overcrossings and seven undercrossings will provide traffic service at interchanges and traffic separation at several intersecting streets. Frontage roads are being constructed to replace local access affected by the freeway alignment.

The work is being done by Gordon H. Ball and Gordon H. Ball, Inc.

The other contract between Sybil Avenue and 173rd Avenue in San Leandro is about one-third complete. $5,571,000 was allotted for this work which, in addition to almost three miles of freeway, includes overcrossings at 150th and 159th Avenues and at Plaza Drive and undercrossings at 164th and 167th Avenues. Generally the freeway is depressed between 150th and 159th Avenues and split-level roadways have been designed to conform to the terrain in this area. Portions of existing Foothill Boulevard, between Plaza Drive and 173rd Avenue, will become a frontage road when the freeway has been completed. Contractor is Gordon H. Ball Enterprises and Price and Harris Construction Co.

173rd to Castro Valley

Design studies are well advanced for one mile of Interstate 580 between 173rd Avenue in Hayward and Strobridge Avenue in Castro Valley. This project will include reconstruction of the interchange at the junction of Routes 238 and 580.

Design studies are also in progress on several projects for the 11-mile portion of Interstate 580 between Castro Valley Junction and the junction with Interstate 680 near Dublin. Work on the portion between Strobridge Avenue and Crow Canyon

Looking toward the west portal through the new bore of the Caldecott Tunnel. To the right is one of the emergency stations spotted at 250-foot intervals within the tunnel. They contain fire extinguishers, a hydrant and public address system. Slots in the ceiling are ventilation ports.

Road includes a channel change and interim grading along Don Castro Regional Park. The latter work is to be expedited to fit improvement plans and construction schedule for the park and a revised freeway agreement for this project was signed by Alameda County in February.

The existing 20 miles of expressway between the intersection of Interstate Routes 580 and 680 and the San Joaquin county line will be converted to six- and eight-lane freeway and design studies for these projects are well advanced. Safety roadside rests and truck stops have been approved for the portion between Vasco Road and west of the San Joaquin county line.

Construction of interchanges within the above limits at Tassajara-Santa Rita Roads near the north city limits of Pleasanton and First Street (Route 84) near Livermore was started in January. The contractor is Gallagher & Burke, Inc. Funds in the amount of $1,367,000 are allotted for this work which should be completed by the end of this year.

Landscoping

Landscaping on Interstate 580 projects has followed closely behind completion of the freeway and this work has been completed to Park Boulevard in Oakland. One such contract is presently in progress between Park Boulevard and Birdsall Avenue.

In addition, $200,000 has been budgeted for landscaping almost two miles of freeway between Gabriel Court and 108th Avenue. Studies are in progress for landscaping the 4½-mile portion between Birdsall Avenue and 108th Avenue and the 2.7-mile section between 173rd Avenue and Gabriel Court.

Interstate Route 680

Approximately 60 percent of the construction on Interstate 680 between Route 580 and one mile north of the Alameda-Contra Costa county line has been completed. Slightly over three miles of freeway is being constructed with interchange facilities at the intersection of Routes 580 and 680 and at Alcosta Boulevard and separation structures at Amador Valley and Dublin Boulevards.

As a part of this project, Interstate 580 is being widened from four to eight lanes within the limits of the Route 580 680 interchange. Frontage roads are being constructed in the vicinity of Alcosta Boulevard and bridges over the Alamo Canal are included in the project. This work, which is completely on new alignment, is expected to be completed late this fall. $5,312,000 has been allotted for this work, which is being performed by the joint venture of Green Construction Co. and Winston Bros. Co.

Design studies are in progress on Route 17 (future Interstate 680) between Alum Rock Avenue in San Jose and near Prune Avenue in Fremont. This routing for Interstate 680 was approved last year in lieu of the former location along Nimitz Freeway.

Plans are nearing completion for almost nine miles of Interstate 680 between Scott's Corner and Interstate 580. This work is expected to be advertised shortly. Interchanges will be provided at Route 84, Sunol Road, Pleasanton-Sunol Road and Bernal Avenue, and twin structures will be constructed across Arroya de la Laguna. A total of $8,450,000 is required to construct this project. Extensive relocation of the Arroya de la Laguna between Arroyo Mocho and Arroyo del Valle is required, and this work is presently underway through cooperative agreement with the Alameda County Flood Control District.

Design studies are in progress for nearly five miles of Route 680 in Fremont between Mission Boulevard near the Warm Springs district and the junction of Routes 238 and 680 in the Mission San Jose district.

Route 13 (Worren Boulevard Freeway)

One and three-tenths miles of four-lane freeway is being constructed on Route 13 between Atlas Avenue and Interstate 580 as a part of a $1,728,000 contract. Access to Route 13 for local traffic will be provided by interchange facilities at Redwood Road and Carson Street. Five reinforced concrete cantilever retaining walls and a pedestrian overcrossing at Leona Heights Park are included in the work. Construction is by the L. C. Smith Co.; the section is expected to be opened to traffic early next year.

The rough grading for this portion of Warren Boulevard Freeway was completed as a part of the project presently under construction on Interstate 580 between Buell Street and Durant Avenue in Oakland. This is the final unit of construction on Route 13 between Route 24 and Route 580. Initial construction on this route between these limits was initiated with Joint Highway District funds contributed by the City of Oakland, County of Alameda and State Highway Fund. Local jurisdictions contributed $150,000 each to this final project.

The $45,000 landscape project at Moraga Avenue Interchange was accepted in March.

A $54,000 project for the revision of drainage facilities and the installation of a pump at Folger Avenue Underpass at the northerly terminus of Route 13 at Ashby Avenue was completed in late April. Prior to this work, the underpass was subject to closure by flooding during periods of heavy rainfall. This work should eliminate that condition.

Route 17 (Nimitz Freeway)

Funds in the amount of $1,300,000 have been budgeted for widening slightly over four miles of Nimitz Freeway to six lanes between Jackson Street in Hayward (Route 92) and Washington Avenue in San Leandro. Provision for widening within the existing median was made in the original construction and this work is expected to be advertised this summer.

Five structures will be widened within these limits: the "A" Street Undercrossing, San Leandro Creek Bridge, Hesperian and Lewelling Boulevard Undercrossings and the Route 17/238 Separation. A double metal beam median barrier will be installed as a part of this project.

A contract for resurfacing Route 17 between Davis Street and 0.3 mile north of Hegenberger Road is in progress. Night paving operations on the southbound lanes were begun late in February but a labor dispute delayed these operations for a while during March. There is $353,000 allotted for this 1.5-mile project.

Funds in the amount of $300,000 have been budgeted for a similar project between 1.1 miles north of Washington Avenue and 0.3 mile north of Davis Street (Route 112) in San Leandro. This contract will include grinding some pavement joints. The contract is expected to be advertised before summer.

Studies by the division and the City of Oakland for new connections to the Nimitz Freeway between 98th Avenue and High Street, to serve the Oakland Coliseum, are well advanced. Interchange design at 66th Avenue is in progress anticipating construction in the next few years. Right-of-way for the 66th Avenue Interchange will be furnished by the City of Oakland.

Projects for additional widening of Nimitz Freeway between Davis Street and Hegenberger Road and between Washington Avenue and Davis Street are being designed.

The contract for landscaping the Marina Boulevard Interchange (First Street) in San Leandro was completed in March, with $11,500 allotted for this work.

Plans have been completed for the erection of 6.8 miles of median barrier on Route 17 between Jarvis Avenue and Jackson Street (Route 92). Design studies for the enlargement of Winton Avenue Interchange in Hayward are currently in progress.

Revisions to the plans for the Industrial Parkway Interchange to provide for future eight lanes on the freeway are being studied. This project includes a scale installation south of Tennyson Road. Rights-of-way for the interchange ramps will be financed by the city.

Design studies are in progress for the construction of an initial two-quadrant cloverleaf interchange at Stevenson Boulevard (formerly P.G. & E. Road). Rights-of-way for this project will be furnished by the City of Fremont under cooperative agreement.

Caldecott Tunnel

Work has been completed on two projects for the renovation of the old Caldecott Tunnel bores, and a third project to provide for four-lane peak hour traffic flow in each direction is in progress. The first of the two contracts called for mechanical and electrical renovation of the old bores, including painting and installing new lights. This work cost approximately $851,000. The other contract included the construction of struts and the installation of a drainage system in the old tunnels at a cost of $310,500. Both projects were completed in March.

Funds in the amount of $339,000 are allotted for the third project which provides for the installation of lane control devices and necessary signing. The devices, which function by use of compressed air, should be fully operative this summer, concurrent with the completion of the freeway project discussed below.

Construction on the new bore for the Caldecott Tunnel was completed, and it was placed in operation in October. This project, which cost approximately $10,897,000, provides a two-lane, 28-foot roadway with a 4-foot sidewalk on one side and a 2½-foot emergency walk on the other. The length of the bore is 3,371 feet. The contract included tiling and lighting the interior, ventilating equipment, fire-protection facilities and a closed-circuit TV system for traffic surveillance.

Route 24

West of the tunnel, a $4,404,000 contract has been in progress since early last year on portions of Route 24 between 0.4 mile west of Warren Boulevard Freeway (Route 13) and the west portal. This work includes the 260-foot-long Kay Overcrossing; a partial interchange, approximately one-half mile east of Lake Temescal on Route 24 and a signalized intersection at Tunnel Road and Route 13, just north of Lake Temescal.

The eastbound traffic lanes are expected to be opened to traffic this summer. At that time it will be possible to operate the central tunnel in reversible direction by use of the new lane control system.

Detailed design studies for Route 24 between Golden Gate Avenue in Oakland and Warren Boulevard Freeway (Route 13) are continuing. These studies include alternate plans for embankment utilizing a variety of short walls to reduce the effect on the adjoining property at the control points. The City of Oakland approved the parallel off-ramp at Patton Street on

Caldecott Tunnel construction. After the walls were painted, new fluorescent strip lighting fixtures were installed. Here a workman inspects the ballast wiring for a strip section.

the portion between Interstate 580 and Golden Gate Avenue in January.

Design studies for the freeway-to-freeway connector ramps between Route 24 and Interstate 580 are well advanced.

The design work east of Golden Gate Avenue to the Nimitz Freeway is being coordinated and scheduled to accommodate both rapid transit and City of Oakland redevelopment. Additional rights-of-way required because of rapid transit between 27th Street and Golden Gate Avenue are being acquired.

Route 92

A contract for the construction of three miles of Route 92 between the San Mateo-Hayward Bridge and Hesperian Boulevard in Hayward was started in February by Ivaldi Bros. & Associates and Andell, Inc. This project will provide a full freeway facility between the bridge and west of Hesperian Boulevard at a cost of approximately $3,111,000. The existing grade crossing of the Southern Pacific Railroad at Mt. Eden will be eliminated by a separation, and access to the freeway will be provided by interchanges at Industrial Boulevard and at the intersection of Clawiter and Eden Landing Roads. Frontage roads will be provided for access to properties west of Clawiter Road. Completion of this project is expected by the summer of 1966.

Design studies for the portion of Route 92 between Route 17 and Interstate 580 near Castro are proceeding, looking toward a freeway agreement with the city.

Other Projects

The landscaping project for the approaches to the Posey and Webster Street Tubes is nearing completion, with some $29,600 allotted. It should be completed this summer.

The contract for the rehabilitation of the Posey Tube Portal buildings was completed in February. This project included steam cleaning, concrete removal and painting at a cost of $32,600.

CONTRA COSTA COUNTY

Interstate Route 680

Construction was completed recently on 6.7 miles of four-lane freeway on Interstate 680 between Danville and Walnut Creek. This project has been open to traffic and Interstate 680 has functioned as a full freeway from Danville to the Benicia-Martinez Bridge since early December. Southerly of Danville, two projects are currently under construction which will complete Interstate 680 within Contra Costa County and Alameda County as far as Interstate 580 (see Alameda County section).

The Danville to Walnut Creek contract is the largest single roadway contract let to date in the bay area and required about two and three-quarters years to complete. The total cost of the work was $13,750,000, including participation by local jurisdictions. Separation structures for interchanges and local traffic are provided at Sycamore Valley, Diablo, El Pintado, El Alamo, El Monte, Stone Valley, Rudgear and Livorna Roads. Four bridges were constructed over San Ramon Creek and overheads were built over the Southern Pacific Railroad at Danville and at South Walnut Creek.

South of Danville, 5½ miles of Route 680 between 1 mile north of the Alameda county line and Sycamore Valley Road is currently under contract. Work was started February 4, 1965, on this $7,700,000 project. The contractor is Fredrickson & Watson Construction Co.

Access to the freeway will be provided at Crow Canyon Road and bridges will be constructed across San Ramon Creek. Other structures include undercrossings at Pine Valley Road and Donegal Avenue and overcrossings at Bollinger Canyon and Norris Canyon Roads and County Road "D" (North San Ramon) to provide for local traffic separation.

Technically, work was not completed until March on a contract on Route 680 between Monument Boule-

The Monument Boulevard project involved improvement of a heavily traveled two-lane road to a modern four-lane arterial. The new Walnut Creek Bridge is visible in the middle of the photo.

yard in Concord and Willow Pass Road, although the freeway lanes and traffic separations on this portion were opened to traffic in January of last year. Construction on Route 680 consisted of completing the Monument Boulevard Interchange and constructing a Y interchange at the intersection of Routes 242 and 680, in addition to grading and surfacing four lanes on Route 680. The remainder of the contract consisted of the construction of nearly four miles of freeway on Route 242 between Monument Boulevard and Olivera Road (see Route 242 below).

Plans are complete for adding two lanes to slightly over six miles of Route 680 between South Walnut Creek Overhead and Route 242 north of Monument Boulevard and design studies are in progress for the future project to add two lanes in the median between Sycamore Valley Road and South Walnut Creek Overhead.

Design studies are in progress for landscaping approximately 3.2 miles of the completed freeway between Walden Road in Walnut Creek and the south city limits of Concord. Studies are also in progress for 6.5 miles of tree and functional planting on portions of Interstate 680 between one mile south of Danville and Crest Avenue in Walnut Creek. One hundred fifty thousand dollars has been budgeted for this work, which will be started this fall.

Route 4

Work was started in the middle of February on the construction of 4.7 miles of four-lane freeway between 0.2 mile west of Cummings Skyway and 0.1 mile west of Howe Road in Martinez. Nine million two hundred fifty-nine thousand dollars has been allotted for this contract, which is expected to be complete in late 1966 or early 1967.

The project is generally on new alignment replacing the tortuous Franklin Canyon route. Gordon H. Ball Enterprises and Syar & Harms are the contractors.

Design studies are being continued for four miles of the future Route 4 freeway between A Street and the Route 4/84 interchange near Neroly Road. This project includes that portion of future Route 84 freeway between Route 4 and the Antioch Bridge.

Looking north from the Sycamore Valley Road interchange south of Danville along the recently completed freeway between Walnut Creek and Danville on Interstate 680.

Route 24

Construction on almost two miles of eight-lane freeway between the east portal of Caldecott Tunnel and Orinda was completed in February. This work, which requires almost 2½ years to complete, cost approximately $6,974,000. Interchanges were constructed at the east portal of the tunnels and at Gateway Boulevard. Cable chain link median barrier was installed throughout the majority of the project and blocked-out metal beam barrier was used in interchange areas.

Work has been completed on two projects for the renovation of the old Caldecott Tunnel bores and a third project to provide for lane-changing devices to accommodate four-lane directional flow is in progress (see Alameda County section).

Preliminary approval has been given to a plan to locate a six-mile portion of the Bay Area Rapid Transit District net-work within the freeway median strip on Route 24 between Orinda and Walnut Creek—subject to negotiation of a satisfactory financing agreement. This location will reduce right of way requirements for the transit facility as well as provide improved aesthetics, but will require reconstruction of the westbound freeway lanes and interchanges.

Interstate Route 80

Funds in the amount of $300,000 have been budgeted for the construction of ramps at County Road 20 on Interstate 80 near San Pablo, and this work is expected to be advertised this fall.

Work was completed in April on a cooperative project for ramp widening at the nothbound off-ramp to San Pablo Dam Road. This work cost approximately $43,500, of which $9,000 was contributed by the City of San Pablo.

Route 242

Although the freeway lanes have been in service for several months, the contract for the construction of the four-lane freeway on Route 242 between Monument Boulevard and Olivera Road was not completed until early March. This work included the construction of Route 680 between Monument Boulevard and Willow Pass Road, which is discussed in connection with that route.

Access to Route 242 for local traffic is provided at interchanges at Willow Pass Road, Concord Avenue and Solano Way. The total allotment for the contract, including work on Interstate 680, was $5,480,000.

A contract for widening Monument Boulevard, the former Route 242 facility, was completed in March. Rights-of-way for this project, between Buskirk Avenue in Pleasant Hill and 0.2 mile west of Oak Grove in Concord, together with $148,000 of construction costs were furnished under cooperative agreements with local jurisdictions. The total cost of the work was $298,000. This facility was constructed to a four-lane conventional highway, including a modern four-lane structure with sidewalks over Walnut Creek.

Work was also completed recently on former State Sign Route 24 (Monument Boulevard and Galindo Street) between Oak Grove Road and Salvio Street in and near Concord. Total cost of this project was $30,800.

MARIN COUNTY

Route 101

Another step toward the conversion of Route 101 to full freeway between the Golden Gate Bridge and central Novato—a distance of nearly 21 miles—was recently completed.

The last segment of this job, 2.7 miles of six- (ultimately eight-) lane freeway between Miller Creek Road and Entrada Drive, took approximately two years to complete at a cost of $4,241,000. The contract was performed by a joint venture of Syar & Harms, Gordon H. Ball and Gordon H. Ball, Inc.

The project, which was completed in the middle of December, included climbing lanes in both directions over St. Vincent's Hill. Interchanges were constructed at Ignacio (San Jose) Boulevard and at Bolling Drive in the vicinity of Pacheco Creek. Access to Hamilton Air Force Base is provided by a frontage road between these interchanges.

Work was started in February on the first of several projects for the eventual reconstruction of six miles of Route 101 to eight-lane freeway between San Quentin Wye and Miller Creek Road interchange. This contract, between Irwin Street and Third Street in San Rafael, will realign streets and off-ramps and provide improved local service on the frontage roads by eliminating points of severe conflict. Funds in the amount of $616,000 have been allotted for this work.

The construction of a freeway-to-freeway interchange at the intersection of Routes 37 and 101 was completed on July 13, 1964. This project, which was started in February of 1963, cost approximately $4,278,000. Five major structures, including separations over the Northwestern Pacific Railroad tracks, were constructed on this contract. The contractor was Peter Kiewit Sons Company.

A six-lane freeway section was constructed opposite Hamilton Air Force Base near Novato. View is north.

Smoller Projects

The contract for landscaping and construction of restroom facilities at the Vista Point area at the north end of the Golden Gate Bridge will be completed shortly. Some $65,600 is allotted for this work. Design studies for the west side parking lot and a freeway connection at this location are suspended pending clarification of Golden Gate Bridge expansion plans.

Work began in March to construct approximately 0.8 of a mile of Route 131 as a four-lane divided conventional highway. This work, along Tiburon Boulevard between Blackfield Drive and beyond Reed Ranch Road, will cost approximately $610,000 and take about seven months to complete.

Portions of existing Tiburon Boulevard will be utilized as a frontage road on the southerly side of Route 131 in conjunction with Greenwood Cove Drive. The contract includes grading 0.4 of a mile between Reed's Underpass at Trestle Glen Drive and west of San Rafael Avenue in Tiburon and placing rock slope protection along Richardson Bay.

A $151,000 contract for resurfacing, reconstruction of shoulders, and the installation of underdrains was completed in February north of Atherton Avenue in Novato on the Redwood Highway (US 101). This work is similar to a project completed in this area last year.

Minor widening has been completed on 0.4 mile of Route 1 between Stinson Beach and three miles southerly. Design studies are also in progress for the replacement of the Stemple Creek Bridge and for drainage improvements between Stinson Beach and Marshall.

Median Barrier

Installation of 5½ miles of median barrier between approximately ½ mile south of Waldo Undercrossing and Corte Madera Creek was recently completed. Several types of experimental glare shields were installed as a part of the project. These included vertical and diagonal plastic strips and expanded metal mesh screen. Almost $187,000 was allotted for this project, of which $39,000 was for the experimental installation of glare shields.

A contract for the installation of median barrier between the north end of the San Rafael Viaduct and the south end of Corte Madera Creek Bridge was started in February. Funds in the amount of $137,000 have been allotted for this 2½-mile project.

Landscaping

The landscaping contract at Tierra Linda Interchange (Manuel T. Freitas Parkway) was completed in August, an $88,500 project. Installation of an irrigation system was included.

Design studies are in progress for 1.1 miles of landscaping south and north of Corte Madera Creek, and for additional planting at Spencer Avenue interchange.

NAPA COUNTY

Route 29

A $955,000 contract to build a 1.2-mile section of four-lane divided freeway in the City of Napa between Old Sonoma Road and Trancas Street (Redwood Road), was completed last May.

Frontage roads were provided on the westerly side between Old Sonoma Road and Laurel Street and in the vicinity of First Street. Major structures were constructed at Napa Creek Bridge and First Street Overcrossing.

An interim project on Route 29 was also completed last May. This project, from two miles north of Trancas Street to 2.7 miles south of Yountville, consisted of increasing skid resistance by resurfacing portions of the existing pavement with open-graded asphalt concrete and replacing raised traffic bars.

Bids were opened on March 24, 1965, for signals, lighting, and widening at Imola West and Jefferson Street in Napa. Some $35,000 is budgeted from State funds. Both the City and County are contributing $5,800.

Other Routes

Construction was completed last September on a 26-foot all-paved section on Route 121 about two miles northeast of Vichy Avenue. Approximately 1.2 miles of widening and minor improvements in alignment were included in the work. This project cost nearly $83,300. On November 6, 1964, the $35,000 contract to realign Route 128 to ease a curve approximately ten miles east of Rutherford was completed.

Future Projects

Plans are being revised for a project on Route 29 between Napa Creek and Trancas Street to include a northbound off-ramp at Lincoln Avenue interchange.

This project will complete Route 29 to a four-lane freeway from south of Imola Avenue to south of Trancas Street.

Design studies are in progress for completing the development of the four-lane expressway north of Trancas Street to two miles north of Yountville, and for an ultimate four-lane freeway between north of Yountville and Ritchie Creek. This project is planned initially as a two-lane expressway bypassing St. Helena.

Design studies are underway for nearly one mile of reconstruction on Route 128 east of Pope Valley Road as a part of the continuing improvement of the existing facility. Funds in the amount of $50,000 have been budgeted for this project. It is the fourth of several contracts of a similar nature, and design studies for another 1.3 miles on Route 128 are in progress.

SAN FRANCISCO COUNTY

Within the past year the most significant developments in San Francisco have been the completion and presentation of two of the most extensive and imaginative studies for urban freeway routes ever undertaken by the Division of Highways.

These involved the development of the Panhandle Parkway extension of Interstate Route 80 from the San Francisco Civic Center to the Golden Gate Bridge and the recently completed studies for Interstate Route 480 from the Embarcadero Freeway, along the north waterfront area to the Golden Gate Bridge.

Route 82

When the section of Route 82 (known locally as the Southern Freeway) from Orizaba Avenue to Mission Street opened to traffic in August, motorists were provided with a safer, signal-free ride from the southwesterly corner of San Francisco to the Bay Bridge and downtown San Francisco via this new route and the James Lick Freeway (US 101).

Construction costs on this new six-lane freeway totaled more than $22,000,000. More than six years and four major construction projects were required to complete the approximately four miles between Orizaba Avenue and the Route 82/101 interchange. The Guy F. Atkinson Company built the interchange, while the firm of Charles L. Harney, Inc., performed the other three contracts.

Many traffic separation structures, major street connections, retaining walls and pedestrian overcrossings were constructed on these projects.

Approximately one-third of the work has been completed on the portion of Route 82 between Newcomb Avenue and Army Street. The project includes construction of a double-deck viaduct transitioning to a single-deck viaduct in the vicinity of Evans Avenue and the construction of ramp connections in the vicinity of Army and Pennsylvania Streets. The latter facilities are an integral part of the future Islais Creek Interchange, to be constructed at the junction of Routes 82 and 87. Some $5,380,000 has been allotted for this contract which is expected to be completed in the spring of 1966.

Structure work on the Clay-Washington ramps to the "Embarcadero" Freeway, shown as it neared completion. The ramps were integrated with the overall plan for the Golden Gateway Redevelopment Project. One of the completed apartment towers appears at lower left. The excavation at the bottom of the photo is the site for a large parking facility.

Route 87

The first unit of Route 87, the future north-south freeway intended to relieve congestion on Route 101, has been budgeted. A total of $9,500,000 has been approved which will cover the construction of nearly 1.5 miles of this eight-lane freeway between Evans Avenue and 18th Street.

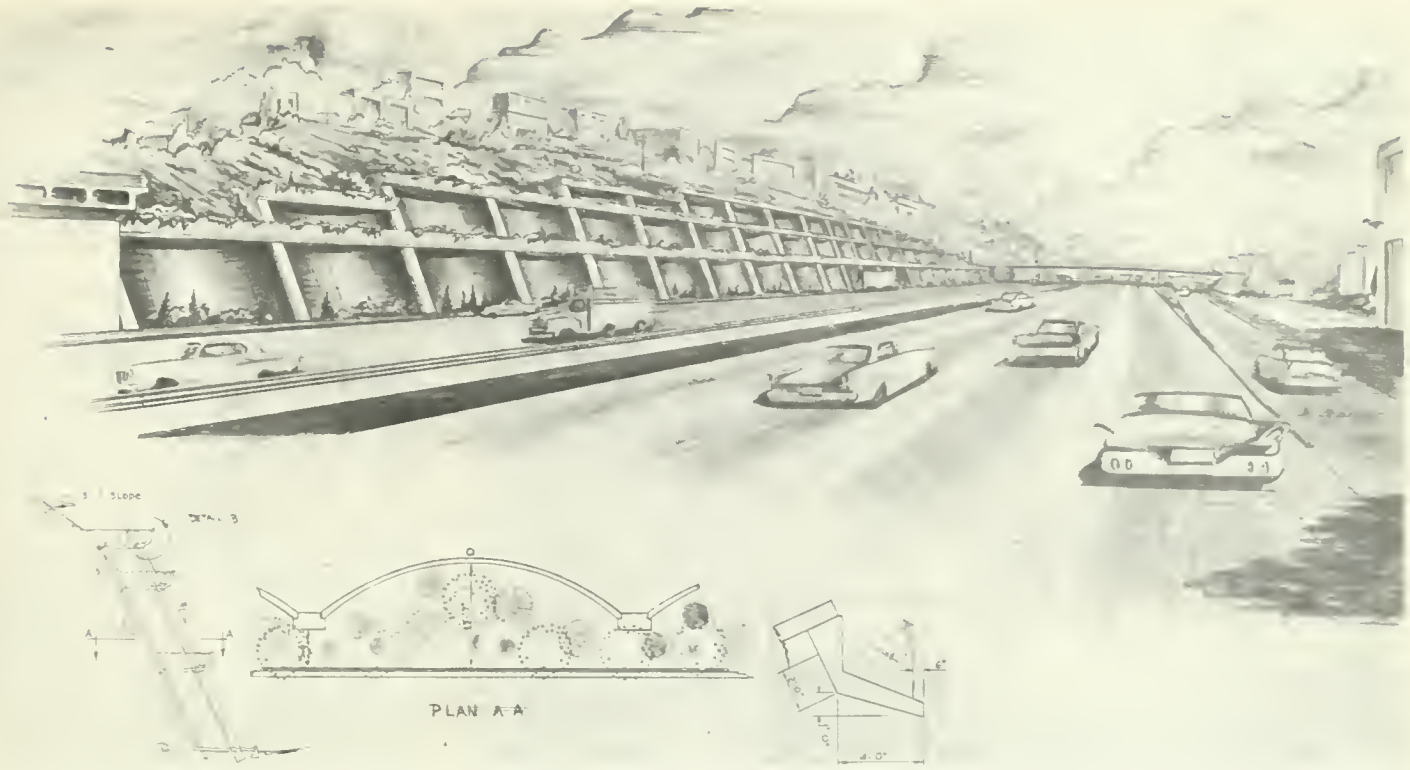
Interchanges to provide access to the freeway will be constructed at 18th and 25th Streets and overcrossings for local traffic separation will be constructed at 18th and 20th Streets.

An unusual feature of this project will be the precast concrete retaining wall in the Potrero Hill area. Planting balconies will be provided in this wall for landscaping intended to enhance the finished appearance of the wall.

Interstate Route 480

The contract for the construction of the Clay and Washington Street ramps has been completed by Stolte, Inc., and these facilities are now open to traffic. The ramps connect Interstate 480 (locally known as the Embarcadero Freeway) with the Golden Gateway redevelopment project in the City of San Francisco and should relieve some of the congestion due to lack of access northerly of Market Street. This project, which included sign structures, signs and lighting, cost approximately $1,422,000.

Location studies on extending Interstate 480 northerly have been completed and a wide range of alternative routings for the proposed location were present to the board of supervisors on March 8, 1965. They include a variety of proposals to extend Interstate 480 from the vicinity of Broad-



An unusual feature of the future eight-lane freeway between Evans Avenue and 18th Street will be the precast retaining wall in the Potrero Hill area. Planting balconies will be provided in this wall for landscaping intended to enhance the finished appearance of the wall.

way and the Embarcadero through the north waterfront area of San Francisco to a connection with the Golden Gate Bridge.

The studies were undertaken at the request of the board of supervisors and were made in cooperation with the city technical staffs, and in association with the architectural form of Eckbo, Dean, Austin and Williams. Among the proposals are a variety of engineering forms, including tunnels under Telegraph and Russian Hills, depressed and elevated designs, and structure along the edge of the bay.

On April 28, 1965, the California Highway Commission took this routing under consideration, after receiving a recommendation from State Highway Engineer J. C. Womack, but deferred further action for 60 days in view of routing studies being conducted by the board of supervisors.

Other Routes

Other current construction within San Francisco is being performed on Route 1 as a part of a contract on Interstate 280 between Eastmoor Avenue in Daly City and north of Alemany Boulevard Overcrossing (see San Mateo County). Route 1 within San Francisco is a connection between Route 82 at San Jose Avenue and Interstate 280 in the vicinity of Alemany Boulevard-Knowles Avenue in Daly City. Within San Francisco, traffic separations are being constructed at Alemany Boulevard and in the vicinity of St. Charles Avenue in addition to the freeway connection. The San Pedro Overcrossing on the Daly City portion of Interstate 280 was opened to traffic in March.

A contract was completed in February for the placing of reflective markers on 4.2 miles of Route 101 (James Lick Freeway) between the San Mateo county line and 17th Street to improve night visibility of traffic striping particularly in rainy weather.

Landscaping

Bids were opened on March 10, 1965, for a project to landscape 2.2 miles of Route 82 between Route 101 and Havelock Street, westerly of James Lick Freeway. There is $267,000 allotted for this work, which will take about nine months to complete.

Plans are being prepared for two additional landscaping projects on Route 82 on portions of the freeway which were completed last fall. Funds in the amount of $135,000 are available for landscaping 1.3 miles of divided freeway between Ocean and San Jose Avenues and $60,000 has been budgeted for landscaping the one-half mile of viaduct between James Lick Freeway (Route 101) and Revere Avenue.

Future Projects

The route was adopted for Routes 87 and 230 between Army Street near Islais Creke and Route 101 near the San Mateo county line last year. Design studies for this portion including interchange studies at both ends are underway.

Design studies are also underway for the extension of Route 87 between 18th Street and Sixth and Brannan Streets. Freeway agreements for this portion have been executed. From Sixth Street to the junction of Routes

87 and Interstate 480 in the vicinity of Howard Street, design studies and the preparation of preliminary freeway agreements are in progress.

Studies for evaluating the feasibility of expanding or modifying Route 101, from the San Mateo county line near Candlestick Point to the Bay Bridge, and Route 80, between the Division Street Wye and Mission Street, to increase operational efficiency are in progress. These studies are being made in cooperation with the city technical staff, particularly in the Army Street area where the city is in the design phase for the construction of a grade separation and new ramps to the freeway.

SAN MATEO COUNTY

Interstate Route 280

A total of five major projects are currently under construction, advertised or financed within San Mateo County on Interstate 280, locally known as the Junipero Serra Freeway. Design studies are being expedited on the remaining portions to insure that this entire facility between San Jose and San Francisco is either completed or under construction in the next four years.

Considerable attention has been given in the design of Interstate 280 to the preservation and, when possible, the enhancement of the natural beauty of the area through which the freeway is located. To assist in these aims, medians of varying width and roadways separated by as much as 40 feet in height are provided, opening up unrestricted vistas of scenic views to both directions of traffic. In addition, the improved architectural treatment of structures and designed configuration of slopes is intended to integrate the roadway with the natural terrain bordering it.

The portion between one-half mile south of Eastmoor Avenue in Daly City and Orizaba Avenue in San Francisco should be opened to traffic in the summer of 1966. Funds in the amount of $9,978,000 are allotted from state highway funds for this work, with additional moneys being provided by the City of Daly City and the San Mateo County Sanitary District.

Interchange facilities are being constructed in the vicinity of Market Street, Washington Street and Alemany Boulevard-Knowles Avenue, all in Daly City, with an on-ramp from San Francisco being provided by modification of the existing Alemany Boulevard Overcrossing at the northerly end of project. Separations for local traffic are provided at San Pedro Road, Washington Street, School Street, Knowles Avenue and at two locations on Junipero Serra Boulevard, which is being realigned.

The San Pedro Road and Washington Street Overcrossings have been completed and opened to traffic, enabling the contractor to resume excavation along the freeway alignment.

Preliminary to the above project was a contract for relocation of storm drains on Junipero Serra Boulevard, approximately one-quarter mile south of Knowles Avenue in Daly City which was completed last May.

In addition to construction on Route 280, the contract includes work on portions of Route 1 which intersect the interstate facility in this vicinity. In San Francisco, traffic separations are being constructed at Alemany Boulevard and in the vicinity of St. Charles Avenue. Other work on Route 1 in Daly City consists of rough grading, drainage and frontage road facilities for a future freeway connection on that route between Routes 1 and 280.

Plans are completed for extension of this interstate facility southerly through Daly City. More than $10,000,000 is budgeted for the 3.3-mile portion of Route 280 from Arroyo Drive in South San Francisco to Eastmoor Avenue in Daly City.

Access to the freeway will be provided through interchanges at Westborough Boulevard, Hickey Boulevard Extension and Collins Avenue Extension. Separations for local traffic will be built at Chinese Cemetery Road and King Drive Extension. All of the proposed extensions will be constructed by other jurisdictions.

San Mateo Creek Bridge

Bids were opened on April 7, 1965, for the construction of approximately two miles of Interstate 280 between Bunker Hill Drive and Black Mountain Road in Hillsborough. Major work on this project is the construction of San Mateo Creek Bridge, although it includes some freeway grading and the placement of embankment for the proposed Hayne Road Interchange. Paving of the freeway will be accomplished on subsequent projects. Some $2,500,000 was included in the 1964–65 budget to partly finance this work, with an additional $4,785,000 being provided in the 1965–66 budget.

The final design of the San Mateo Creek Bridge by the Division of Highways Bridge Department is the result of many studies. The studies and a model of the design were reviewed with the Peninsula Highway Policy Committee last year.

Bids were opened May 19, 1965, for another major project on Interstate 280 between Summit Drive and San Bruno Avenue in San Bruno. This construction includes 1.7 miles of freeway and the placement of four embankments between Summit Drive and Larkspur Drive, as well as additional embankment construction on Route 1 on the portion between Route 280 and St. Francis Boulevard.

Excess Material

Material for these embankments will come from the section of the route between Larkspur Drive and Route 186 in San Bruno. The rest of the excess material will be hauled to the San Francisco Airport or some other optional disposal site. Some $8,500,000 is available for this project.

Farther south, the structure carrying Route 280 over the Stanford University two-mile linear accelerator will be completed this summer. The work was undertaken early to maintain coordination with work being preformed on the accelerator.

Design work on a unit of Interstate 280 from Raymundo Drive in Woodside to the San Mateo Creek Bridge is temporarily delayed due to consideration of an alternate location requested by the San Francisco Water Department and the San Mateo County Board of Supervisors.

Route 1

Although the freeway lanes were opened to traffic on January 29, 1965, the remaining work on Route 1 between Sharp Park Road and Manor Drive in Pacifica was not completed until spring. Two and one-half miles of freeway were constructed on this $4,364,000 project by McNamara Corporation, Ltd. Interchanges were constructed at Sharp Park Road, Brighton Road-Paloma Avenue and Manor Drive, plus a pedestrian overcrossing at Milagra Drive and a similar undercrossing at Sharp Park Golf Course.

As an interim improvement a contract for the widening of Route 1 to four 10-foot traffic lanes, without shoulders, between Linda Mar Boulevard and one mile south of Sharp Park Road was completed in February. A six-foot-wide pedestrian walkway was built along the westerly side of the reconstructed highway. The City of Pacifica obtained the necessary rights of entry and slope easements.

The development of Route 1 in Daly City between Route 35 and Interstate 280 is being handled in connection with construction of three separate projects. The earthwork and frontage road construction is discussed herein in connection with two projects on Interstate 280. Design studies for structure construction and paving the portion between Routes 35 and 280 are in progress.

A resurfacing and channelization contract on Route 82 (El Camino Real) between Finger Avenue in Redwood City and Central Avenue in San Carlos was completed in February. Also completed in February was a project for drainage improvements at Watkins Avenue. This work is intended to alleviate flooding at Atherton Creek.

Numerous signal and channelization revisions are being designed on El Camino Real in the cities of San Mateo, Burlingame and Redwood City, and a similar project is underway in Belmont.

Other Routes

The contract for the placing of approach embankments for structures on Route 92 near the west end of the San Mateo-Hayward Bridge was completed in March. This scheduling will permit settlement prior to bridge construction in this relatively unstable area.

The superstructure contract for the new San Mateo-Hayward Bridge is well underway and many of the column bents have been poured. This work is administered by the Division of Bay Toll Crossings and is expected to be completed in the summer of 1967.

Bids were opened on March 24, 1965, for a project to widen the 4.8-mile section of Bayshore Freeway (Route 101) between 19th Avenue in San Mateo (Route 92) and Broadway in Burlingame to eight lanes. The

Traffic has more direct and convenient access to Woodside Road, bypassing downtown Redwood City, since completion of the new expressway.

The new freeway through Pacifica looking north along the coast from above the Sharp Park Golf Course.

work includes rough grading for the Whipple Avenue Interchange, construction of median barrier, and the updating of signing and lighting. Funds in the amount of $1,100,000 are budgeted.

Other Routes

The Route 82/114 separation on the project on Route 114 between Cypress Avenue, south of El Camino Real and Bayshore Freeway, was opened to traffic March 27, 1965. This facility replaces the former "Five Points" signalized intersection on El Camino Real. The remaining structure work at Redwood Junction Overhead over the Southern Pacific Railroad is nearly completed, with the entire contract to be finished late this summer.

In addition to the structures, a four-lane expressway is being built on 1.1 miles of this route. The sum of $2,329,000 was allotted for construction of the project, of which $1,040,000 was contributed by the City of Redwood City and County of San Mateo.

Landscaping

The plant-establishment period ended in March on the landscaping contract for the completed portion of Route 92 freeway between north of West Hillsdale Boulevard Extension and Grant Street. Additional oak tree planting was made possible as a part of the project by the contribution of $1,000 received from owners of the Borel Estate, adjacent to the freeway.

SANTA CLARA COUNTY

Interstate Route 280

Completion of one major contract and the anticipated completion of another on Interstate Route 280 by June will provide full freeway service to the rapidly growing areas in the heart of the Santa Clara Valley.

Almost five miles of six-lane freeway between Saratoga Avenue in San Jose and Stelling Road in Cupertino was completed and opened to traffic in March of this year. Access to the freeway is provided by interchanges at Lawrence Expressway-Stevens Creek Boulevard, Wolfe Road and Saratoga-Sunnyvale Road with a separation for local traffic having been constructed at Blaney Avenue. Generally the freeway is elevated in the vicinity of Lawrence Expressway-Stevens Creek Boulevard and depressed from Saratoga-Sunnyvale Road to Stelling Road. This $4,432,000 job was done by Fredrickson & Watson Construction Company.

North of this portion, one mile of six-lane construction is in progress on Route 280 between Saratoga-Sunnyvale Road and the vicinity of the future Route 280/85 interchange. This $1,000,000 contract, which includes an interim four-lane connection to future Route 85 just south of Homestead Road, should be opened to traffic this summer.

The only major structure included in this project is the construction of Stelling Road Overcrossing.

A contract was awarded in March and work is underway for constructing six lanes of Route 280 freeway between northwest of Foothill Boule-

vard and Magdalena Avenue and eight lanes of freeway between Magdalena Avenue and Page Mill Road. The median area varies from a minimum width of 36 feet to 100 feet, and the profiles of the roadways are separated to adapt the freeway to the natural terrain. Contractor is Green Construction Co. & Winston Bros. Co.

Interchanges are to be constructed at Magdalena and El Monte Avenues and ramp connections will be provided at Page Mill Road. Undercrossings will be built at St. Joseph Avenue, Robleda Road, La Barranca Way, Elena Road and Arastradero Road. Additional structures will be constructed at Maryknoll Overhead and Mora Drive Overcrossing. The "new look" in structure design on this project was the result of many studies to provide an architectural treatment which will both enhance their aesthetic appearance and blend with the natural beauty of the area through which the route passes.

Funds in the amount of $8,725,000 are included in the budget for construction of this seven-mile facility.

The project for the portion between 0.3 mile west of Stelling Road and 0.6 mile west of Foothill Boulevard is expected to be advertised in the next few months, with $3,600,000 available. Portions of the county's Foothill Expressway will be constructed as a part of this two-mile project.

Route 82

Work was completed in March on the four-lane divided widening project on Monterey Road (Route 82) between Ford Road and Curtner Avenue in San Jose. This construction eliminates the former three-lane facility, which had been in use for many years.

Total cost was $1,142,000, of which a portion was contributed by Santa Clara County.

Route 85

Construction is approximately two-thirds complete on Route 85 between Homestead Road in Cupertino and Route 101 in Mountain View. The facility should be opened to traffic this winter. In combination with the aforementioned construction on Inter-

The new section of Interstate 280 west of San Jose was completed in March. At lower left is Wolfe Road interchange.

The Oregan Expressway interchange on the Bayshore Freeway was completed in February. The interchange at lower right is with Embarcadero Road.

Looking north along Route 85 construction from above the El Camino Real interchange. Route 85 crosses over Route 237 near the center of the photo.

state 280 in this vicinity, a freeway loop is provided for traffic generated within the fast growing suburban areas.

Five and one-half miles of four-lane freeway are being constructed on this $6,600,000 contract. Access for local traffic will be provided by interchanges at Fremont and Evelyn Avenues, Homestead Road, Routes 82 (El Camino Real), 101 (Bayshore Freeway), and 237; Moffett Boulevard, and the proposed County of Santa Clara Central Expressway. Other structures include an overhead at the Southern Pacific Railroad and bridges across Stevens Creek at three locations.

Work has just started on a widening project on Routes 9 and 85 between Oak Place in Saratoga and 0.1 mile north of the Southern Pacific Railroad at Azule. This project, 2.3 miles in length, will cost approximately $706,000, of which $125,000 will be contributed by the County of Santa Clara. Approximately six months will be required to complete it.

Route 101

A project for the construction of nearly 19 miles of median barrier on Bayshore Freeway between Redwood Creek in Redwood City and Route 87 in San Jose was recently completed. The contract also included the installation of sign lighting systems between University Avenue in Palo Alto and Redwood Creek Bridge.

Construction of the Oregon Avenue Interchange on Bayshore Freeway was completed in March. This trumpet-type interchange serves the County of Santa Clara's newly constructed Oregon Avenue expressway. The structure and ramp connections augment the Embarcadero Road Interchange.

Currently, a contract is underway for the construction of interchanges on Route 101 between south of Tully Road and Coyote Creek. Traffic separation and access will be provided at the Capitol Expressway and Hellyer Avenue.

Work on connecting roads to the interchanges, being done under the jurisdiction of Santa Clara County, will be completed at the time the structures on this $1,277,000 project area ready to be opened to traffic.

Route 101 Freeway

Bids will be opened June 23, 1965, for converting the remaining 4½ miles of the present expressway on Route 101 between McKee Road in San Jose and Ford Road to an initial four-lane freeway. Major construction on this $1,900,000 project will be an interchange at Story Road and a separation structure at San Antonio Street.

Route 237

One and one-half miles of improved facilities on Route 237 between El Camino Real and Bernardo Avenue in Mountain View was opened to traffic last May. A four-lane divided expressway was constructed between El Camino Real and Church Street and a four-lane freeway from Church Street to Sylvan Avenue. This project, which cost approximately $1,568,000 and included the construction of the East Mountain View Overhead over the Southern Pacific tracks, was performed by a joint venture of L. C. Smith Company and Concar Ranch & Enterprises, Inc.

SANTA CRUZ COUNTY

Route 1

Adverse weather conditions slowed completion of the grading project on Cabrillo Highway (Route 1) near Watsonville. This five-mile project, between the Pajaro River and northwest of Watsonville, is completely on new alignment bypassing Watsonville to the west. Cost will be approximately $2,063,000.

Also included as part of this contract are an overcrossing at Harkins Slough Road and a bridge across Struve Slough, as well as rough grading of portions of Route 129 connecting the bypass to Main Street in Watsonville.

Surfacing is not part of the present contract because a surcharge is required on fills to expedite settlement and to stabilize freeway embankment through the marshy terrain. The budget, however, includes $3,000,000 for completing this project.

Construction on this phase will not begin until the surcharge has had sufficient time to accomplish its purpose. At that time the work will include removal of the surcharge and completion of the separation structures at the junctions of Route 1 with Route 129 and Route 152.

In addition to the paving of 3.6 miles of four-lane highway on Cabrillo Highway, 1.6 miles will be paved on Route 129 between Route 1 and Main Street in Watsonville. An interchange facility will be constructed at the junction of Route 1 and 152. It is anticipated that advertising for bids will be submitted in November 1965.

The first phase of construction on the Watsonville Bypass has been completed. For the next year the work will be allowed to stand while foundation materials settle; then the final phase of the work will be started. The view is southeast, toward Monterey County.

Projects in Santa Cruz

A project for the construction of left-turn storage lanes and modifications to the existing signal system at the Route 1 freeway terminus and Mission Street in Santa Cruz was recently completed. This work was administered by the City of Santa Cruz, in connection with their improvement of Chestnut Street. The state contributed $18,000.

The sum of $110,000 has been budgeted for 0.5 mile of reconstruction and resurfacing on Route 1 between Green Street and Rigg Street in Santa Cruz.

SONOMA COUNTY

Route 101

The completion and opening to traffic of two major adjoining projects on the Redwood Highway late last year, totaling almost $3,500,000 in construction costs, now provides the motorists of Sonoma County with more than five miles of four-lane freeway between Lytton and Cloverdale, as a part of the conversion of the Redwood Highway to a modern freeway facility.

One $2,297,000 contract between Washington School Road and Hiatt Road was completed on August 17, 1964. This work, known locally as the "Asti Bypass," included undercrossing and access ramps at Dutcher Creek Road and Asti Post Office Road, in addition to 3.5 miles of four-lane freeway. It was performed by McNamara Corp.

Cleanup and minor installations were completed in March on the relocated portion of the Redwood Highway immediately to the south between Canyon Road and Washington School Road. It was opened to traffic on December 9, 1964.

This new 1.7-mile section of four-lane freeway includes the Chianti un-

A panorama of the new US 101 freeway north of Geyserville in Sonoma County. The view is north, showing the Russian River (right).

Construction continues on US 101 near Santa Rosa. Interchange in the foreground is Steele Lane.

dercrossing, which provides a connection between the frontage roads which were constructed on both sides of the freeway. This work, done by Fredrickson Brothers, bypasses the former sharp alignment at Zanzi's Corner.

Routes have been adopted for the remainder of Route 101 within Sonoma County.

Route 12/101 Interchange

The project for the four-lane freeway and expressway on Route 12 between Occidental Road and east of South E Street in Santa Rosa was completed in December. The freeway lanes constructed under this $4,900,000 contract by Peter Kiewit Sons' Company have been open to traffic since June of last year.

This job was basically on Route 101. Work on Route 12 was necessary to make the new three-level interchange at the intersection of Routes 12 and 101 operational.

Separation structures for local traffic were built at Olive Street, Santa Rosa Avenue and Dutton Avenue. Other structures include an overhead over the Northwestern Pacific Railroad tracks in the vicinity of Roberts Avenue and the Earle Street Pedestrian Overcrossing on Route 101.

Steele Lane

With design completed in the vicinity of Santa Rosa for the conversion of the present expressway through the city to a full freeway, construction is presently underway between Edwards Avenue and Russell Avenue. Work on this project, which includes the Steele Lane Interchange, is approximately two-thirds complete, even though construction has been delayed somewhat by inclement weather. Completion of this contract is scheduled for this summer.

In addition to the diamond-type interchange at Steele Lane, frontage roads are being constructed to serve local traffic to the adjacent shopping center and the county administration center.

Route 1

Bids were opened March 31, 1965, for the reconstruction of 1.6 miles of two-lane, all-paved highway on Route 1 approximately 11 miles north of Fort Ross. The project calls for improved alignment and drainage.

Work was completed last spring on a project between three miles north of Bodega Bay and 0.2 mile south of Bridgehaven for the replacement of inadequate culverts. Culvert pipe was jacked under the roadway during the construction of this project.

Other Routes

Bids were opened April 7, 1965, to reconstruct Route 116 between 0.5 mile and 2.1 miles east of Austin Creek near Big Bend, west of Monte Rio. The 1.2 miles of two-lane conventional highway has been budgeted at $320,000. Design studies for the remaining portions of this route between Austin Creek and Monte Rio are in progress. Bids were opened in March for landscaping and tree planting on Route 12 between Roseland and Brookwood Avenue, east of South E Street. Funds amounting to $200,000 have been budgeted for the project.

STATUS OF DISTRICT 4—FREEWAY AND EXPRESSWAY PROJECTS

April 1965

New route	Description	Total miles	Completed projects		Under contract		Budgeted construction		Right-of-way expended and budgeted
			Miles	Construction cost	Miles	Construction cost	Miles	Construction cost	
I-80	Central Freeway	1.8	1.8	$11,653,000					$8,533,099
I-80	San Francisco to Carquinez Bridge (portions)	18.2	18.2	[d]63,506,000		$64,000		$300,000	14,418,676
I-280	Junipero Serra Freeway, from Route 17 at Moorpark Avenue in San Jose to San Francisco county line	43.9	4.7	6,161,000	17.6	32,572,000	10.2	[a]16,042,000	52,617,576
	Park Presidio Freeway, from Golden Gate Bridge to Fulton Avenue	2.1	1.2	1,448,000					2,582
I-480	Golden Gate Freeway, from Embarcadero Freeway to Golden Gate Bridge	3.3							957,581
	Embarcadero Freeway	1.5	1.5	14,842,000		1,531,000			12,432,864
I-580	MacArthur Freeway, distribution structure to Castro Valley	15.3	8.7	28,283,000	6.6	17,937,000		200,000	73,054,376
	Castro Valley to San Joaquin county line	31.8	31.4	11,647,000	0.9	2,850,000	0.4	1,350,000	6,448,942
I-680	From I-280 at Moorpark Avenue to Warm Springs via Alum Rock Avenue	18.3							4,566,347
	Warm Springs to I-580 (US 50)	21.1	4.7	6,200,000			8.7	4,115,000	7,340,256
	I-580 (US 50) to Walnut Creek	16.0	10.3	16,389,000	8.3	13,020,000		163,000	13,520,934
	Walnut Creek to Monument	3.4	3.4	9,322,000				235,000	6,413,323
	Monument to Solano county line	7.4	7.4	[c]17,545,000					4,141,959
1	Cabrillo Highway, from south of Watsonville to 4 miles south of Davenport (portions)	22.8	21.8	[g]11,578,000			1.0	2,100,000	3,145,137
	Moss Beach to San Jose Avenue at Route 82 (portions)	17.8	9.0	7,604,000	0.4	950,000			10,330,716
4	Arnold Industrial Freeway, from Hercules to Antioch Bridge	34.1	14.7	4,737,000	5.0	8,800,000			3,422,502
12	Sebastopol to Kenwood	17.7	4.1	5,200,000		200,000			6,165,837
	Kenwood to south of Sonoma at Route 121	14.0							
	From Route 29 to Solano county line	3.3							
13	Warren Boulevard Freeway, from Route 24 near Lake Temescal to MacArthur Freeway	5.6	4.1	[f]7,018,000	1.5	2,439,000		45,000	2,273,509
17	From Santa Cruz to Route 101 in San Jose	19.9	19.9	19,068,000					12,308,443
	Nimitz Freeway, from Route 101 at Bayshore Freeway to Warm Springs	8.9	8.9	4,435,000					883,608
	Connection from 17 to 680	1.0							284,814
	Nimitz Freeway, from Warm Springs to distribution structure	33.8	32.4	56,495,000		300,000		1,658,000	20,947,126
	From I-80 near Albany to Route 101 near San Rafael	9.9	2.2	1,992,000					2,814,971
24	Grove Shafter Freeway, from Nimitz Freeway (Route 17) to Warren Boulevard Freeway	4.8							28,518,735
	From Warren Boulevard Freeway to Walnut Creek	11.0	9.5	28,944,000	1.5	5,255,000		45,000	1,521,198
29	From Solano county line to Calistoga (portions)	36.9	25.4	6,350,000				[a]1,305,000	5,193,327
35	From south of Route 1/35 interchange to San Matio-San Francisco county line	2.9	2.9	829,000					1,231,782
37	From Route 101 at Ignacio to Solano county line	9.7	6.3	4,872,000					697,082
61	Bay Farm Island Bridge and approaches	0.6	0.6	2,062,000					165,033
	Webster Street and Posey Tubes	1.1	1.1	18,716,000					2,643,072
77	Shepherd Canyon Freeway, from Warren Boulevard Freeway to Route 24 in Lafayette	10.3							663,027
82	Southern and Southern Embarcadero Extension Freeway, from Route 1 at San Jose Avenue to Route 87 near Army Street (portions)	5.4	4.4	[b]27,326,000	0.7	6,367,000	0.3	1,200,000	26,647,258

STATUS OF DISTRICT 4—FREEWAY AND EXPRESSWAY PROJECTS—Continued

April 1965

New route	Description	Total miles	Completed projects		Under contract		Budgeted construction		Right-of-way expended and budgeted
			Miles	Construction cost	Miles	Construction cost	Miles	Construction cost	
84	From east of I-280 to west end of Dumbarton Bridge	6.4							$445,847
	From 2.6 miles east of Dumbarton Bridge to Route 238 at Niles	5.7							
	From I-680 near Sunol to I-580 near Livermore	9.7							
85	West Valley Freeway, from Route 101 south of San Jose to Route 17	10.0							867,866
	From Route 17 to Bayshore Freeway Route 101 at Mountain View	13.6			5.5	$6,669,000		$[a]400,000	6,464,183
87	Guadalupe Freeway, from Bayshore Freeway Route 101 to West Valley Freeway Route 85	9.5							
	From Routes 82/87 interchange near Army Street to I-480	3.0					0.8	5,695,000	4,000,000
92	19th Avenue Freeway, from Junipero Serra Freeway I-280 to Alameda county line at San Mateo Bridge (portions)	8.0	2.3	$5,235,000					7,618,529
	From San Mateo county line to Nimitz Freeway (Route 17)	6.8			3.1	3,500,000			1,363,075
101	San Benito county line to Ford Road south of San Jose	27.9	5.8	1,093,000					545,839
	Bayshore Freeway, from Ford Road to Southern Freeway in San Francisco	52.9	52.4	[a]62,901,000	(7.4)	2,287,000	(4.6)	2,029,000	28,353,099
	James Lick Memorial Freeway	3.0	3.0	11,445,000					12,870,844
	Redwood Freeway, Golden Gate Bridge to Mendocino county line	84.3	78.0	[c]64,439,000	1.1	1,911,000		72,000	21,641,742
114	West of Route 82 to Bayshore Freeway Route 101 in Redwood City	1.1			1.1	[b]2,250,000			2,875,709
121	From Route 37 near Sears Point to Route 29 in Napa at Imola Avenue	16.8	1.1	1,124,000					123,885
152	Pacheco Pass, from 1 mile east of Bells Station to Merced county line	5.3	5.3	1,702,000					12,393
186	Sweeney Ridge, west of Route 35 to Bayshore Freeway (Route 101)	4.0							1,011,373
237	Mountain View-Alviso Freeway, from El Camino Real (Route 82) to Nimitz Freeway (I-680)	10.5	7.7	[a]3,803,000			2.0	[a]2,905,000	2,772,319
238	Freeway Connection from Nimitz Freeway to MacArthur Freeway (I-580)	2.2	2.2	2,803,000					2,236,852
242	North of Monument in Pleasant Hill to Route 4, Concord	3.4		226,000	3.2	3,150,000			1,879,232
		739.7	414.9	$547,964,000	56.5	$112,052,000	23.4	$41,059,000	$430,033,529

[a] Includes some funds contributed by cooperating agencies.
[b] Includes total of $1,600,000 by City of San Francisco.
[c] Includes total of $5,000,000 by Golden Gate Bridge and Highway District.
[d] $29,117,000 Toll Bridge Funds in this amount.
[e] $6,833,000 from Toll Bridge Funds.
[f] City of Oakland and Alameda County contributions included in this figure.
[g] Includes $690,000 by District 4.
[h] Includes total of $1,051,000 by City of Redwood City.
[i] County of Alameda contribution included in this figure.

Temporary low-level bridge at Orleans to carry traffic while new bridge over Klamath is being constructed. This will be a major project.

Northwest Roads

Back to Normal—Almost

At noon on May 12, 1965, the last detour on storm-damaged northwest state highways was eliminated when, with appropriate ceremony, the Robinson Ferry Bridge, which carries US 101 over the lower Eel River, was reopened. This crossing, also known as the Paul F. Mudgett Memorial Bridge, suffered the loss of more than 600 feet of its structure in the December 1964 floods, and was made famous throughout the United States by Neil Hulbert of the *Humboldt Times*, in his widely reprinted aerial photo which showed the broken spans with the floodwaters rushing through the gap.

Present at the reopening ceremonies were mayors of several Humboldt County towns, the chairman of the county board of supervisors, the president of the Redwood Empire Association, and various other dignitaries. It was an important occasion to these northwest residents, because it assured them their timber products would flow more smoothly to market, and that the tourists so important to their economy would be able to travel through the redwood country the same as they had in previous years.

Reopening of the bridge eliminated use of Humboldt County's Blue Slide Road as a detour. This is a section of county road which follows along the south side of the Eel and rejoins US 101 at Fernbridge. Although very little longer in miles, the detour road was designed neither for high speed nor heavy traffic loads, and its retirement from heavy duty represents considerable saving in time.

Prior to the completion of the bridge repair project, that section of freeway in the Fortuna-Alton area damaged by the flood had already been repaired.

US 101 and US 199 (the Redwood Highway), and US 299 which crosses the mountains from Eureka to Redding and the Sacramento Valley, have now been resurfaced and striped for their entire lengths. On the Redwood Highway travelers may experience short delays until approximately August 15 along the Eel River just south of Pepperwood, where a major repair contract is in progress, and there will be signal-controlled one-way traffic across the Scotia-Rio Dell Bridge until completion of repairs there in August.

A temporary low level bridge is in use on Route 96 at Orleans, to replace the structure destroyed by the Klamath River. Traffic can now move over this route freely, although it will be some months before all the damaged sections on this route are completely back to normal.

Since so many of the road fills and bridges were temporary, any substantial rises in the river levels would have been disastrous, undoing the work of weeks, but nature was cooperative. There were no heavy rains of sustained duration during the spring, and although there were occasional rises in the rivers, the temporary installations have not been damaged. During the summer months most of these temporary repairs will be consolidated or replaced by permanent structures.

Repairs have been made or contracts have been let for permanent bridge repair or replacements in all cases of bridge destruction by the 1964 floods, except the Orleans crossing, which is under study. When design is completed, it is to be 14 feet higher than the previous bridge, but construction cannot be completed until some time in 1966. The other permanent bridges now under construction on the Van Duzen and Smith Rivers have urgency provisions in their contracts requiring their completion by December 1, 1965.

Due to the additional funds released by the temporary gasoline tax provisions, new construction also can go forward on the Redwood Highway. A contract was let in June for a multimillion-dollar project extending the Redwood Freeway northward seven miles to a few miles south of Scotia. The old route will be retained for tourist travel as has been done in the past in creating the Avenue of the Giants.

Looking north from Rio Dell side of Eel River, along repaired Robinson's Ferry Bridge, reopened in mid-May.

View along Route 96 which follows the Trinity-Klamath system. This popular sportsman's route is passable, but requires care in places.

Nonskid Deck

18,000 Studs Used to 'Rough Up' Surface on Napa River Bridge

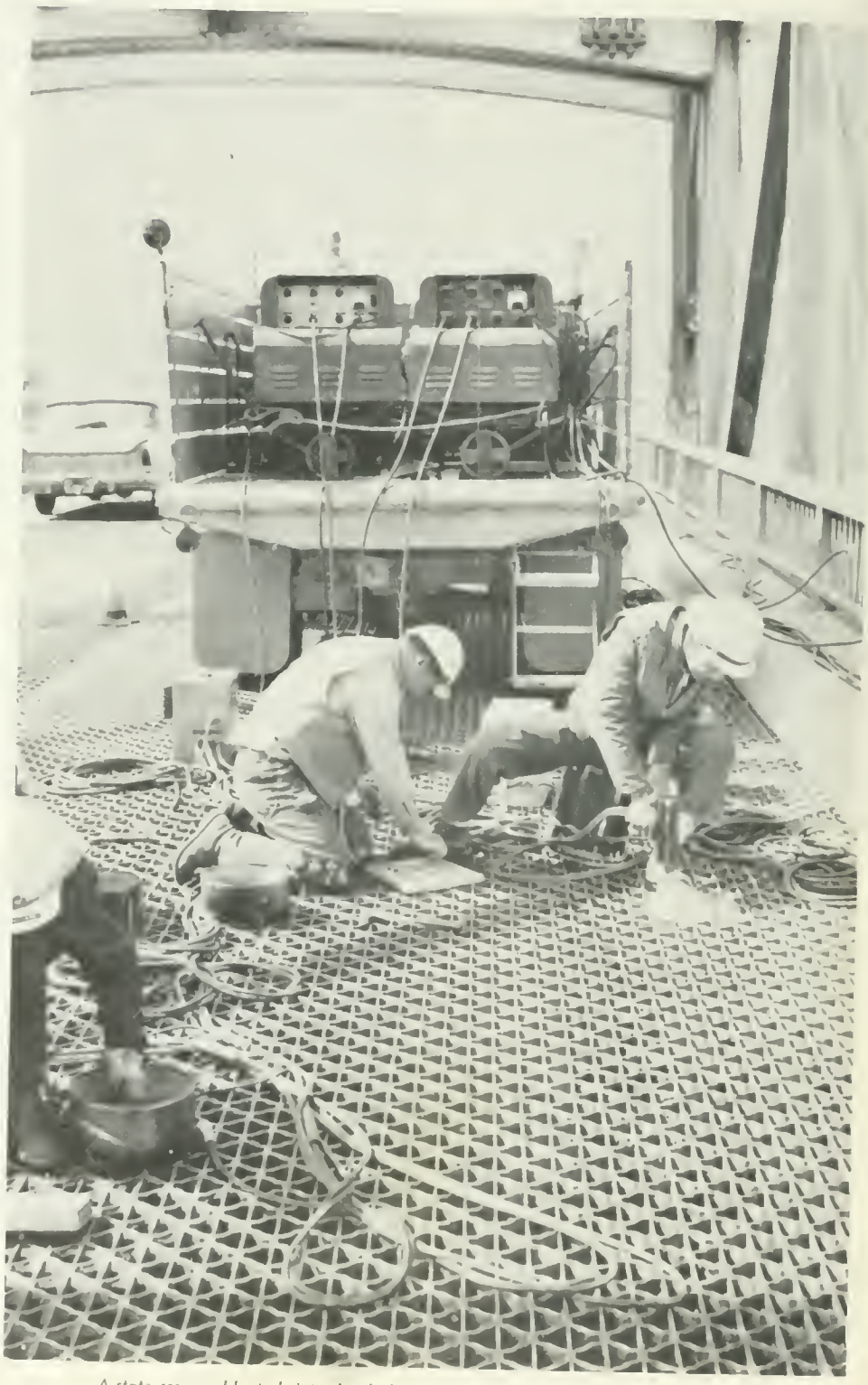
By CHARLES P. CARTER, Senior Highway Superintendent

A "roughing-up" job was recently done on the open grid deck of the Maxwell Bridge over the Napa River on State Route 29 at the southerly edge of the City of Napa. This 132-foot two-lane lift span presented a skid problem in damp weather. The process consisted of welding over 18,000 studs to the deck, leaving a "hobnail" effect. The deck is a steel grid type consisting of longitudinal bars on edge 2½ inches apart with zigzag bars for spacers.

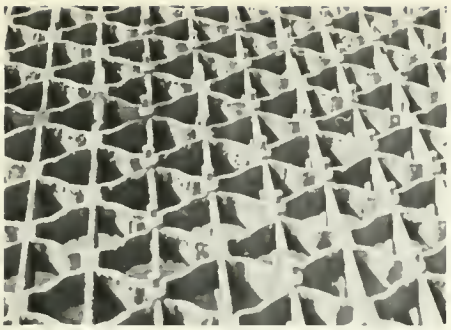
In recent years as traffic volume increased and skidding accidents were occurring, the deck was treated with an epoxy adhesive covered with aluminum oxide grits. This process cost about $2,500, and it was necesary to repeat the treatment 18 months later at a cost of $2,000. With the continued increase in traffic a yearly treatment would be necessary. The same areas were covered with welded studs at a cost of $3,800, and the treatment is estimated to last 10 years or longer.

The work was performed by state forces under the supervision of Highway Superintendent Paul Loeffler of Napa and his senior foreman, George Henderson. The ⅜-inch steel studs were purchased. Welding guns and the battery-powered welding units were rented by service contract.

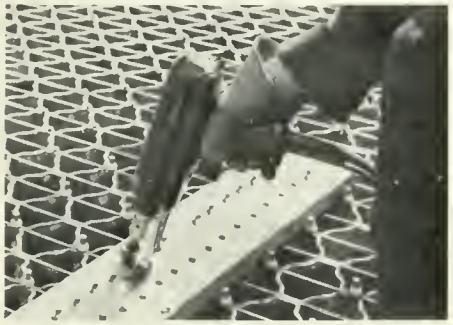
Studs were welded at the bar intersections of the grid deck resulting in a pattern 5 inches apart in longitudinal and transverse directions. The intermediate longitudinal bars were spotted with studs at 15-inch centers to break up any sway pattern. The studs as welded on are 1 inch high to fit the gun. They are grooved, and a single hammer tap breaks them off at the groove leaving a welded button ⅜



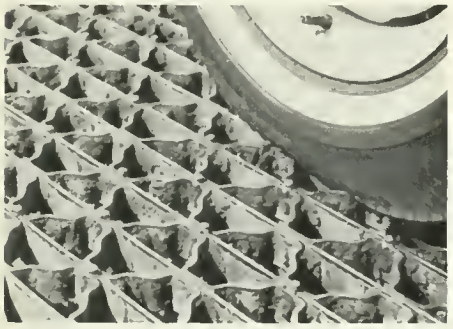
A state crew welds studs into the deck grid with battery-powered units set on truck.



This photo shows the studs in place before being knocked off. The white collar around each one is an insulating ferrule used in the welding process. It breaks off with the stud.



Studs were inserted in the gun from a holding board made by the crew to speed the operation.



A view of the bridge deck after the studs had been welded giving a hobnail effect which greatly reduces skidding accidents.

inch in diameter and ¼ inch high. The crew consisted of seven men welding the studs in addition to two flagmen.

The state maintenance crew were unfamiliar with the operation of the stud guns, but after a short time they were placing studs at the rate of four to six a minute per man. This resulted in the job being completed in 3½ days against the estimated time of 6 days. The previous treatments of epoxy and abrasives had taken over a week each time. As the traffic must be controlled in one lane, this inconvenience of several days' duration will no longer be necessary.

This is the first state highway bridge in California treated with this process. As there are a number of bridges on the state highway system with the open grid decks, the effectiveness of this treatment may prompt its use in other locations having a skid problem. The only other location in the state where this treatment has been used is on the Admiral Heim Bridge in the City of Long Beach.

FLOOD VICTIMS GET HELP FROM FELLOW EMPLOYEES

Division of Highways employees throughout the state raised more than $8,200 through donations to aid fellow workers in Districts 1 and 2 who suffered loss of homes and household goods during the Christmas flood.

Presentation of the money in the form of checks to the individual employees was made by Deputy State Highway Engineer George Langsner on April 15 at the District 1 office in Eureka.

Flood losses suffered by the employees ranged from $14,000 to $200 and totaled more than $52,000. One employee had his house and its furnishings swept away. Several others had their houses flooded, with total or nearly total loss to furnishings and other possessions.

Distribution of the aid fund was made on a prorated scale to the recipients. Amounts of the 12 checks presented ranged from $2,190 to $30.

The division committee which handled the collection and distribution of the fund included Paul C. Sheridan, division office engineer, and William Z. Hegy and Everett Thomas, assistant district engineers of District 1 at Eureka.

John L. Piper

John L. Piper, former construction engineer for District 3 in Marysville, who retired in 1947, died at Menlo Park on April 9. He was 82.

A native of Kentucky, Piper joined the Division of Highways in 1912.

He directed the pioneer snow removal program on Highway 40 (now Interstate 80) over Donner Summit in 1932 and played an important role in the road's subsequent development as an all-weather highway.

He also aided in the development of concrete and asphaltic highway construction methods in California.

Prior to his state service, he was construction superintendent on a portion of the original Los Angeles aqueduct system through Mojave from Owens Valley.

He is survived by his wife, Agnes, and two sons, Donald B., of Atherton, and Lacy, of Santa Monica.

Compaction Control

Nuclear Unit Measures Soil Moisture, Density

By WILLIAM G. WEBER, JR., Senior Materials and Research Engineer
and ROBERT E. SMITH, Assistant Physical Testing Engineer

The art of compaction control of embankments is in a state of change from hand methods to automation. From August 20, 1964, to November 20 of this year, a new nuclear device for measuring the in-place moisture and density of compacted soils was evaluated by Headquarters Construction Department and the Materials and Research Department. The device is a mobile truck and trailer mounted instrument called the road logger developed by the Lane-Wells Company, of Houston, Texas.

This traveling nuclear gauge makes a continuous recording or trace of moisture and density as it is driven over the soil surface. Figure 1 shows the truck and trailer ready to begin logging, and Figure 2 is an illustration of the permanent and continuous record of field data. It differs from conventional practice in that density is presented as wet density and moisture in pounds per cubic foot rather than percent. This graph may be studied to determine the effectiveness of a contractor's effort, variation in moistures, uniformity of compaction, and other factors.

Density Probe

The density probe is mounted in the trailer shown in Figure 3. When traveling the probe is secured within the body of the trailer, and in the logging position it is lowered hydraulically to within an inch of the ground. The density probe then rolls on its own wheels to maintain this one-inch air gap between the soil and the unit.

A 0.43-curie source of cobalt 60 is used in the density probe. This is a considerably stronger source than those used in the more familiar portable units. However, it is more than amply shielded by a tungsten-lead-steel carrier. This shield is of the "collimating" type, which means that the gamma radiation emerges principally straight downward. The radiation is then scattered within the soil, and some of the secondary radiation is bounced back to the shielded scintillation detector which is mounted a fixed distance from the source.

Higher density material will absorb more of the radiation than low density soil, and this difference is sensed by the detector tube. The electronic instrumentation is so calibrated so that these changes in the amount of radia-

FIGURE 1—The moisture and density units in traveling position under the truck and trailer of the road logger.

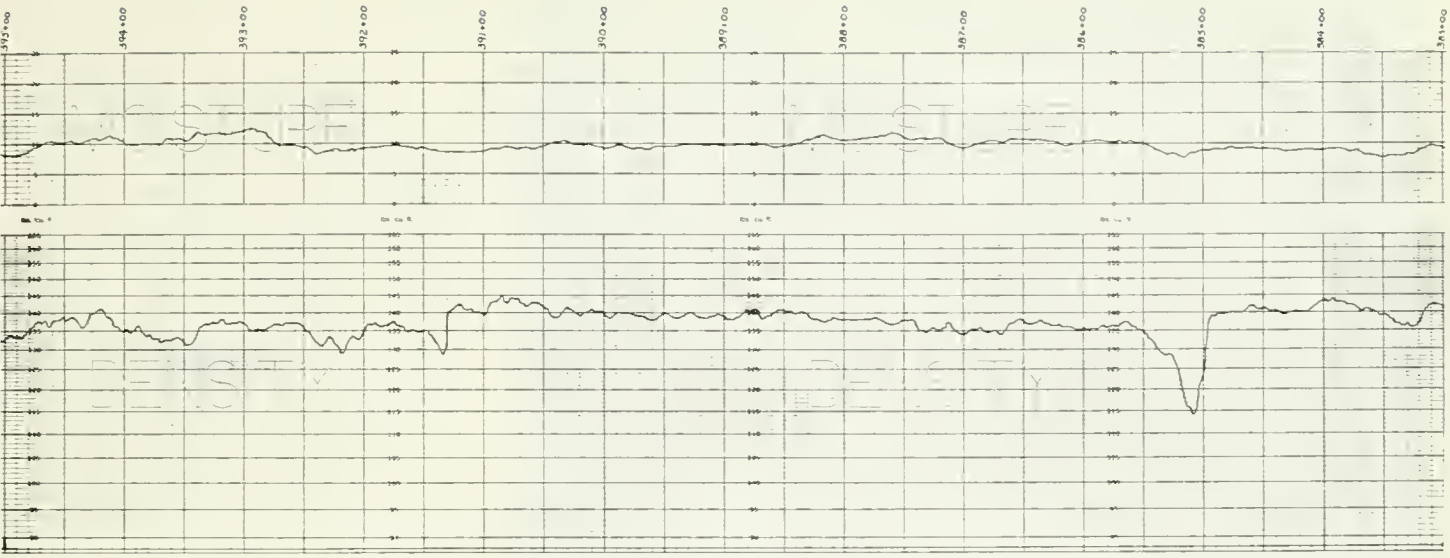


FIGURE 2—Continuous road logger graph of moisture (top) and density (bottom) from Wells Road in Santa Paula.

tion returned are directly interpreted in terms of wet density.

Moisture Unit

The moisture unit is mounted within the truck, Figure 4, and is also raised and lowered hydraulically; it too has a separate set of wheels to maintain a constant one-inch air gap when traveling in the logging position. A five-curie source of plutonium mixed with beryllium is used in the moisture-sensing unit. This source emits principally high energy neutrons with a minimum of gamma radiation. The high energy neutrons are moderated by the water in the soil, and on return are detected by a boron trifluoride pickup tube.

The moisture and density-sensing units measure a volume of material 12 to 15 inches wide, by 6 to 8 inches deep, by approximately 5 to 10 feet long. The 5- to 10-foot dimension depends on the speed of travel and on the choice of time constant of integration on the rate meter. Thus, any point on the graphs represent an integral value for 5 to 10 feet of roadway. These factors can be changed at will by the operator to suit local requirements. Figure 5 shows the recorder and electronic equipment which is located in the cab of the truck.

An approximate total of 180 miles of embankment and structural section was logged throughout the state, in various districts. Several factors that might affect the results from the road logger were given careful attention by the attendant personnel. For example, the effect of logging speed was studied by going over the same course at various speeds. Reproducibility of results was investigated by making duplicate runs over a controlled course. A close check was made of the instrument it-

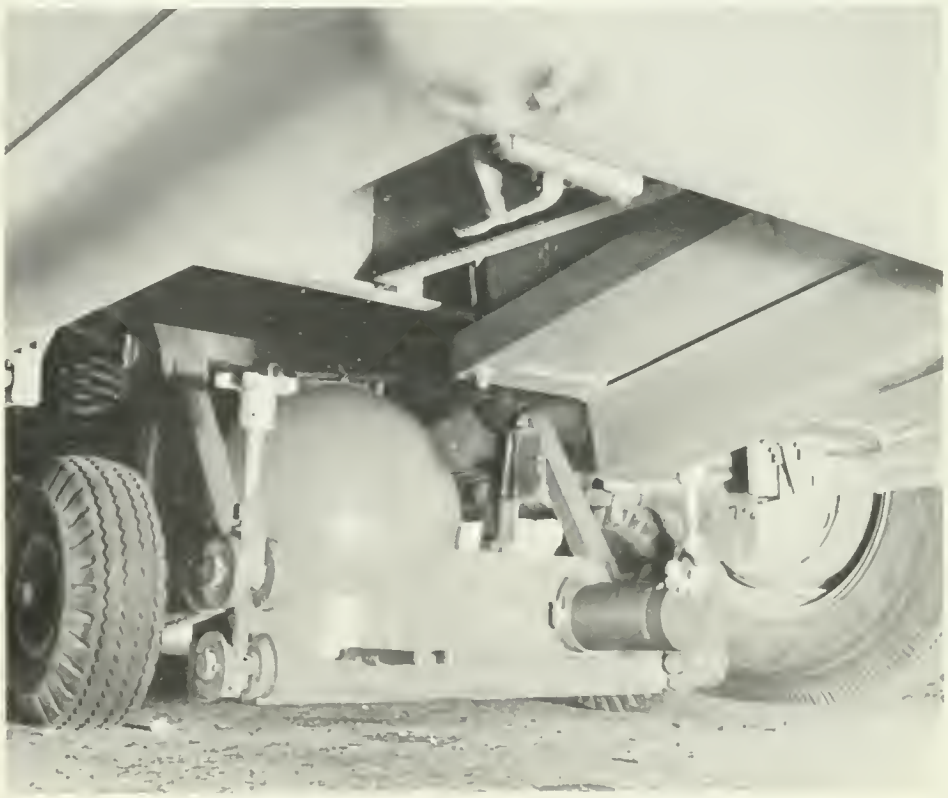


FIGURE 3—The density unit lowered into logging position.

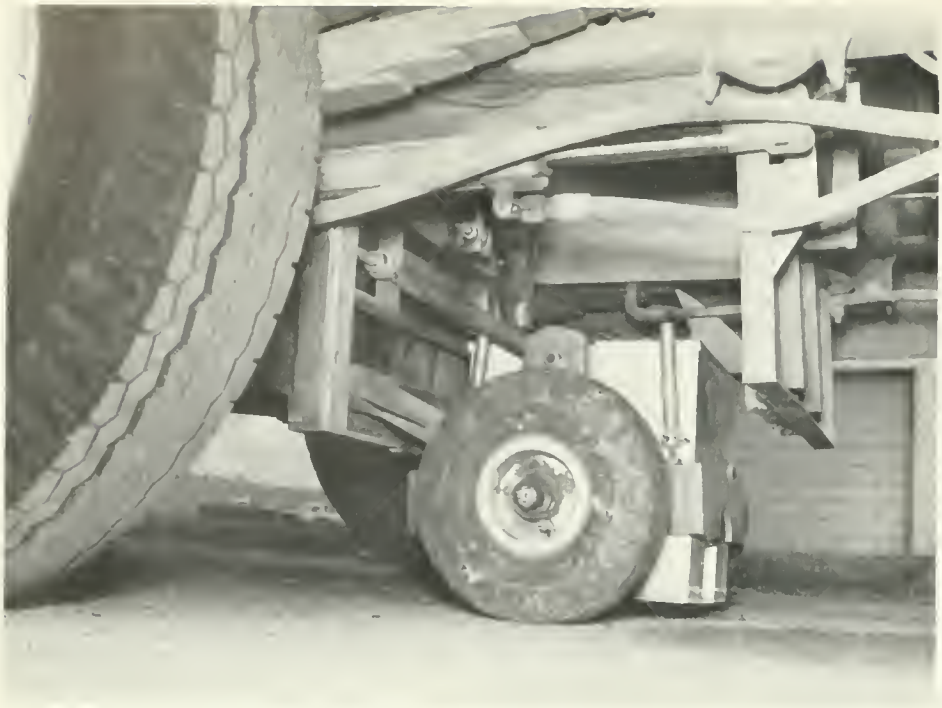


FIGURE 4—The moisture unit lowered into logging position.

FIGURE 5—The recording unit and electronic equipment may be regulated by the driver or his assistant.

self with regard to stability and durability.

Roughness a Problem

An item of particular importance was the determination of the roughness of a surface upon which the unit could be used. Many of our embankments do not have what could be called a smooth surface at any time during construction; and there was some doubt that such a device could be used on these embankments. The men in charge of the road logger were told to "give it a try." It was found that it could be employed over much rougher terrain than originally anticipated.

The technical evaluation of the road logger with regard to its accuracy was approached in several ways. A direct comparison or correlation with the conventional sand volume density and ovendry moistures was made. For example, a specific spot would be marked on the grade and both moving and static readings with the mobile nuclear device would be made. Several sand volumes (usually four) were then taken about a foot apart and centered at the location. The average density and moisture of these holes were then used to correlate with the road logger data.

Statistical Method Also Used

There is some difficulty with the above comparison because, at best, there are differences in the volumes measured by the two methods. In other words, each may be equally right and not exactly agree. Therefore, a statistical approach will also be used to check on the accuracy of the road logger. The approach is roundabout, whereby the overall picture of density variation for a given job as portrayed by the logger is tabulated. This is then compared with the equivalent information obtained by the conventional sand volume tests which were used in the density control for the job. These two independent methods of measurement should reflect the same overall distribution of density variation for that project.

The cooperation and active participation by the districts in this program is playing a very important part in finding the possible practical applications of the Lane-Wells road logger. Part of the time the unit was in the field it was placed under their direction for scheduling, and they were requested to simulate actual use. Their comments will strongly influence the final consensus as to the possible uses of the mobile moisture-density apparatus.

Design Models

New Techniques Result In Greater Versatility

By R. M. COLLINS, District Design Engineer

The importance of the use of models as a tool in the design of such features as undercrossings, overcrossings, separations, overheads, etc., has long been recognized. In order to qualify as an acceptable working tool, such a model should be accurate as to scale, easy and quick to assemble, and fully adjustable so that revisions can be made to the model as design progresses.

After a great deal of experimentation, District 8 has developed a model

As a base for the models, blocks of styrofoam are combined as desired and framed with wood.

An aerial contour map of the area is stretched over the styrofoam base.

Ground elevation "shots" are represented by single black-topped dowels. Note the roadway construction of plastic strips and "T" pegs for support. In this particular model, balsa wood templates were used in an experimental fashion to show the shape of a finished interchange.

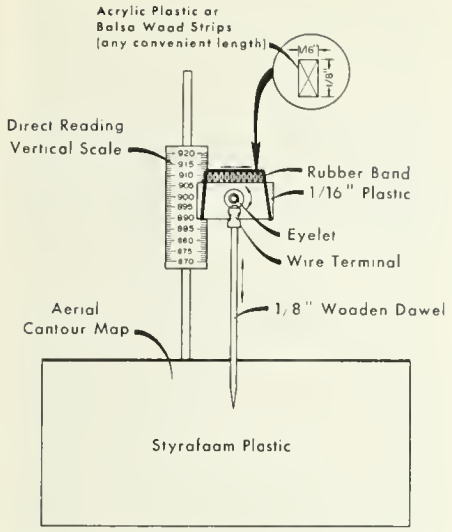
A closeup of one of the versatile "T" pegs.

that embodies, to a great degree, the above-mentioned features.

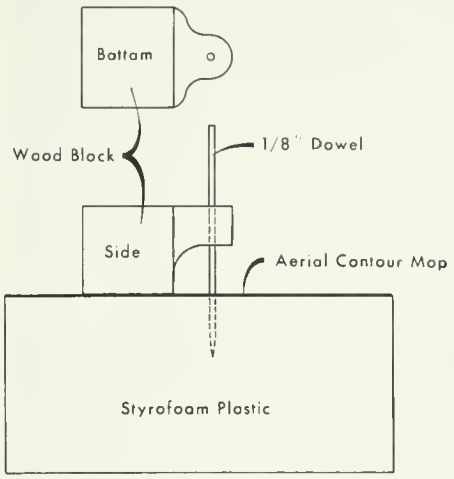
Procedure

Following is a general outline of methods and materials being used by District 8 in the construction of engineering models, which are called, for obvious reasons, "stick" models.

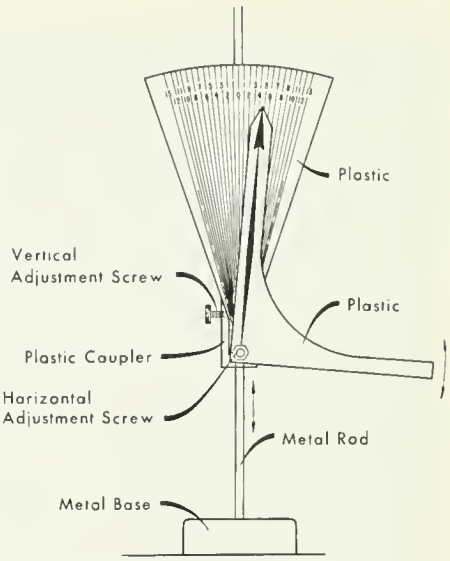
First, a print of an aerial contour map of the area concerned (usually at a scale of $1'' = 50'$) is stretched over a 3-inch thick base of styrofoam to form a surface which is an arbitrary datum from which all vertical measurements are taken. Commercially available 3" x 12" x 36" blocks of styrofoam are combined as desired and framed with wood. The vertical scale usually used is $1'' = 25'$. Smaller scales such as $1'' = 200'$ are sometimes used in the preliminary stages



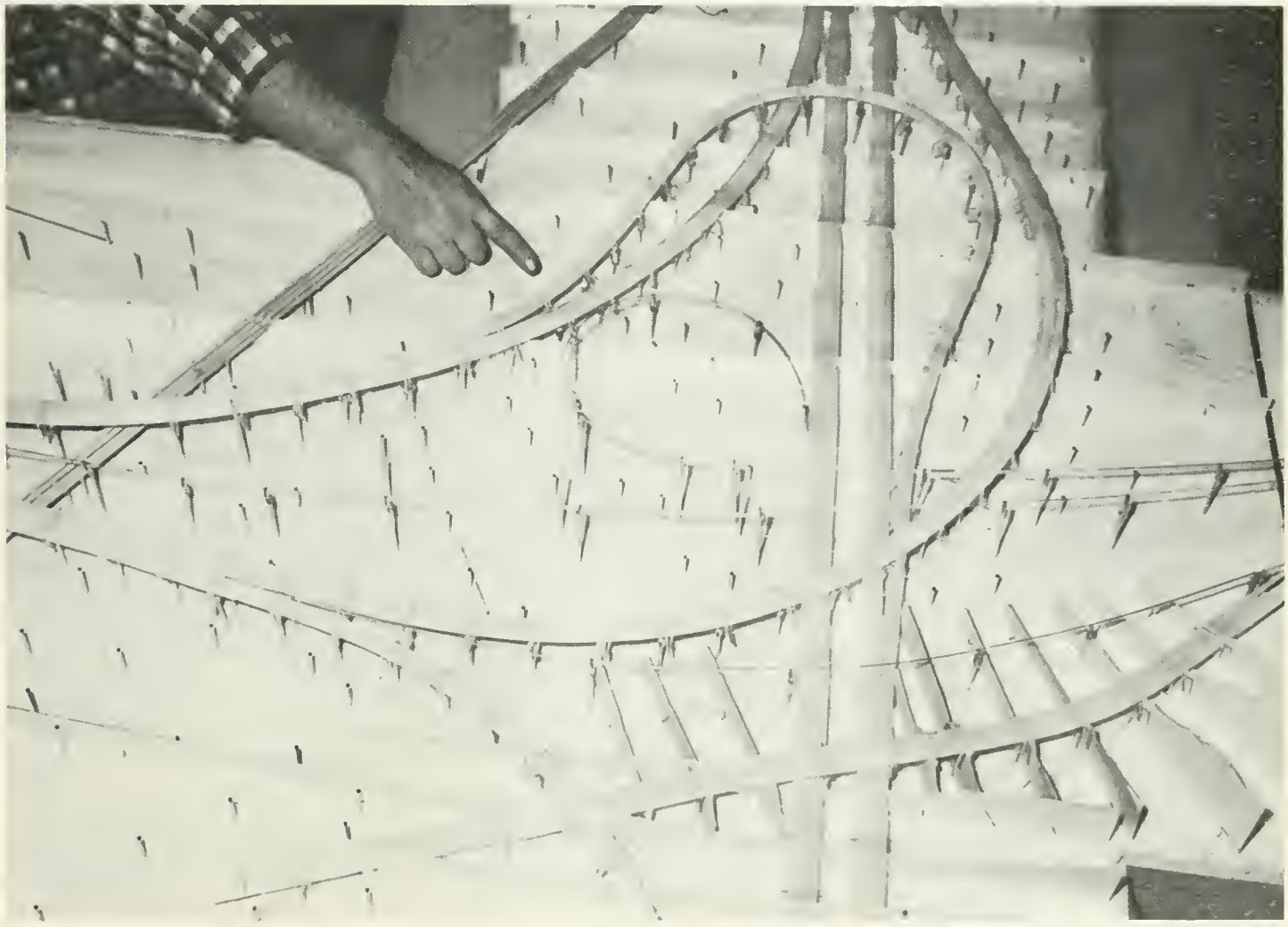
DETAIL OF THE VERSATILE "T" PEG AND THE TOOL FOR MEASURING VERTICAL ELEVATIONS



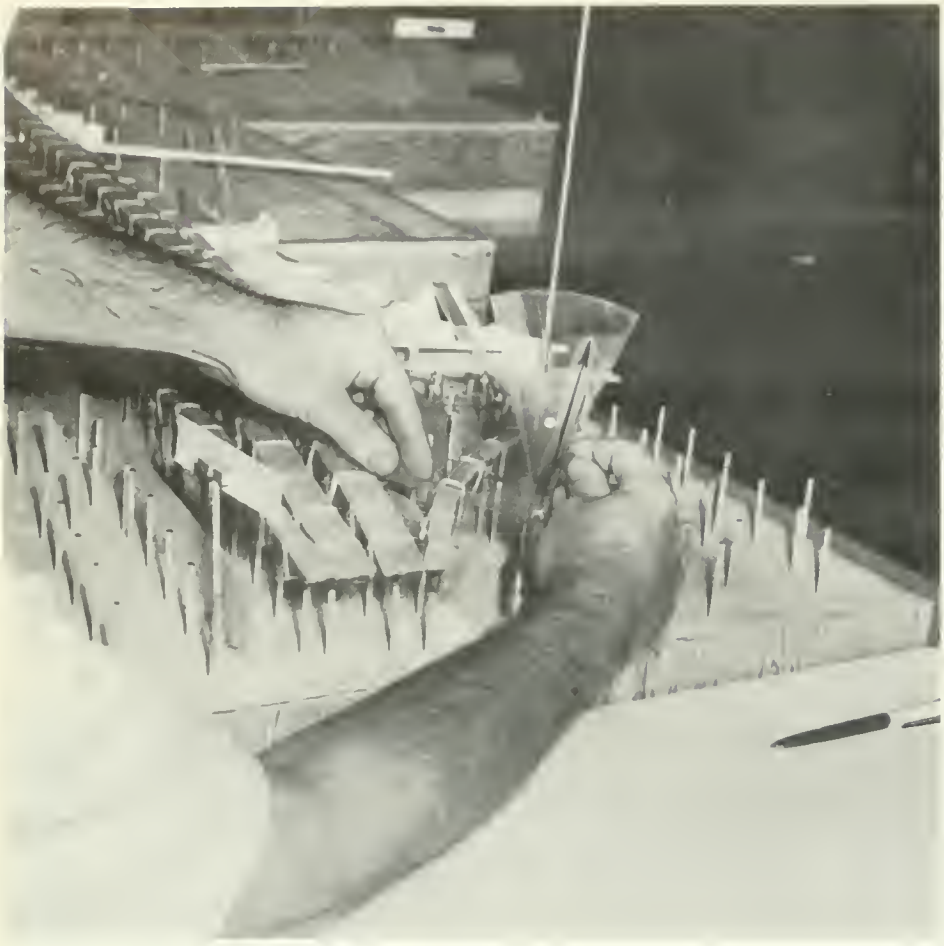
DETAIL OF TOOL USED IN PUNCHING VERTICAL HOLES IN THE STYROFOAM BASE



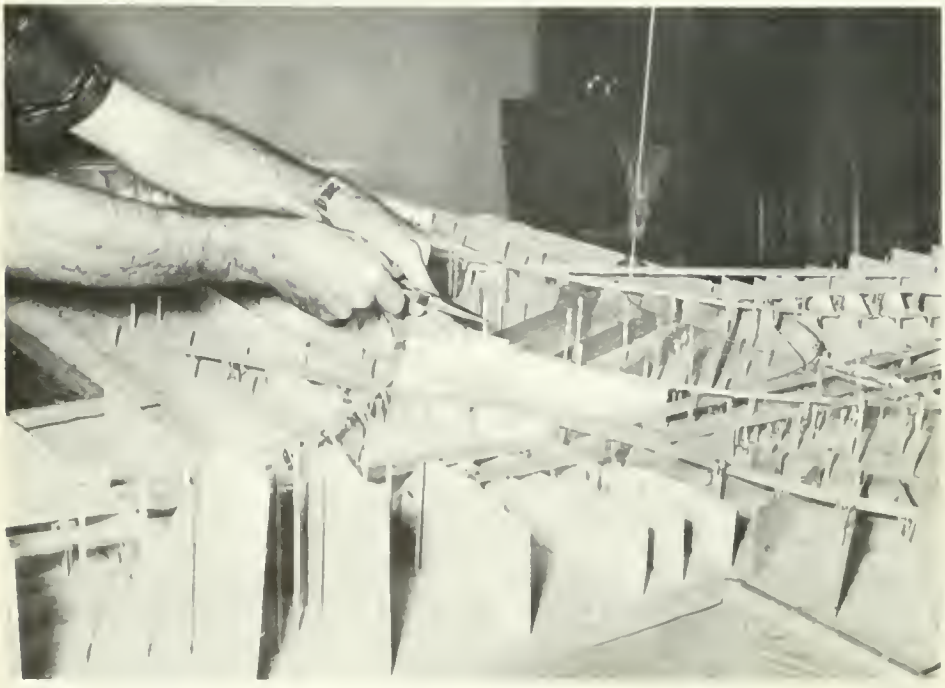
DETAIL OF TOOL USED IN SETTING AND CHECKING SUPERELEVATION



Use of plastic strips for roadways and "T" pegs for supports permits extreme flexibility of design.



Tool developed for setting and checking superelevation being used to check one of the roadways on a model (see drawing on previous page).



Wooden pegs may be set with ease to the desired elevation. Note the use of styrofoam in forming contour graded areas and the use of wooden templates for ground elevations.

of design. Models of this latter type can be assembled very readily, usually by one man in one day.

Second, existing controls are placed. Original ground elevation "shots" are represented each by single "black-topped" dowels punched into grade. Existing roads, railroads, and so forth are reproduced and placed to actual grade.

Roadways of Plastic

The roadways are constructed of multiple side-by-side strips of plastic. Experiments were conducted using balsa wood for the roadways, but plastic strips were found to be better. Placed side by side and held by small rubber bands, these roadway templates readily bend to permit vertical and horizontal curvature. One-eighth-inch by one-sixteenth-inch plastic strips are used. The strips are placed on edge with the 1/16″ dimension horizontal. The plastic that is currently being used is acrylic plastic, sawed 1/8″ wide from 1/16″ thick sheets. Butyrate plastic could be used, although it is softer and does not have as much "memory" or spring as acrylic plastic.

The roadways are fastened with rubber bands to "T" pegs. The pegs can be readily punched into the styrofoam base and adjusted to desired elevation. This "T" peg is really the key to the versatility of the models, since it may be adjusted readily both vertically and horizontal, and with the adjustable cross member, superelevation may be set or adjusted as desired.

The dowels used in the "T" pegs and grade pegs are made of wood. Experiments were made using metal dowels, but wood dowels were found to remain more firmly in position in the styrofoam base, even after repeated adjustments. Metal dowels will slip if adjustments in elevation are attempted.

Tool Checks Superelevation

A tool has also been developed for setting and checking superelevation and also a tool for measuring vertical elevations. (*See attached sketches.*)

Briefly, the steps that are gone through in order to construct a model are as follows:

1. Lay out blocks of styrofoam to cover the area involved. Bind together with a frame or box and mount contour map thereon, bringing edges of map down sides of box and stapling them snugly.

2. To reproduce existing roadways, ramps, and so forth, punch "T" pegs in along centerline spaced about three or four inches apart. To set these pegs, first punch vertical holes in the styrofoam using a pointed dowel with a vertical guide, such as a vertical groove in the side of a wooden block. Next, push the "T" pegs into grade.

3. Assemble roadways to widths and lengths desired and fasten to the "T" pegs with rubber bands. Merge of ramps with main line is smoothly affected by bringing outside strips around continuously, then staggering added strips into the "V."

4. Punch "grade" pegs in surrounding terrain as desired.

5. Designer then studies and physically tries any scheme desired.

6. When a solution is reached, results are scaled, plotted, and then precised by conventional methods.

Shaping the styrofoam to the desired contours.

Applications

While our basic purpose has been to facilitate preliminary design, we are also able to become aware sooner of vertical mismatched features.

Design of freeway signing also benefits from a check with the model.

By the use of the models, it is possible to determine the most aesthetic and useful contour grading. This is done by shaping styrofoam to the desired form, using 0.2-inch-thick (for a vertical scale of 1″ = 25′) styrofoam sheets. The styrofoam sheets are of two colors, green and beige. The colors are used alternately, each sheet representing a 5-foot vertical distance. When the designer has arrived at the most desirable contour grading by use of the model, the shape of each layer of styrofoam, each of which would represent a five-foot contour interval, is duplicated on a plan sheet. Difficult drainage problems can be easily studied and solved by this method of preparing contour grading plans.

Other benefits, obviously, are that such models are valuable in presenting ideas to local agencies and in assisting the resident engineer and the contractor in visualizing the work in early construction.

District 8 developed the use of the "stick" models about two years ago. Since then the results of the developments have been disseminated throughout the state, and it is gratifying to note that the use of such models is becoming widespread throughout the other districts.

Transferring a shoped contour interval to a drawing.

Recent Retirements For Highways Listed

District 1

Vivien A. Gutsch, associate highway engineer, 35 years.

District 2

Randall A. Gay, highway maintenance man II, 19 years; George W. Sorsoli, highway foreman, 38 years.

District 3

Cecil R. Harden, highway foreman, 36 years; Henry N. Wallace, assistant highway engineer, 10 years.

District 4

Lawrence D. Bigelow, highway foreman, 31 years; Albert H. Jackson, assistant highway engineer, 13 years; Edmund W. Silverfoote, highway landscape specialist I, 33 years; Lucile Stephens, drafting aid II, 11 years.

District 5

Benjamin L. Potter, senior highway traffic signal technician, 16 years.

District 6

Lloyd Allen, Jr., assistant highway engineer, 18 years; Leslie Tresidder, assistant highway engineer, 42 years.

District 7

Otis Bray, highway maintenance man II, 33 years; John A. Parenti, senior delineator, 42 years; William J. Simmons, highway maintenance man III, 29 years; Lena M. Smith, intermediate clerk, 8 years.

District 8

Maynard L. Goode, assistant highway engineer, 34 years.

District 9

Daisy M. Powers, highway field office assistant, 17 years.

District 10

Walter S. Arneson, drawbridge operator, 11 years; Earl D. Freeman, drawbridge operator 23 years; Clinton D. Greenwook, office building engineer, 32 years; Francis J. Leithold, highway engineering associate, 28 years; James T. Sola, highway maintenance man II, 32 years.

District 11

Milton C. Higgs, groundsman, 16 years.

Headquarters Office

Ruth A. Coleman, reproduction machine operator, 12 years; Frances R. Gallagher, intermediate clerk, 19 years.

Headquarters Shop

Ora A. Johnson, machine parts coordinator, 41 years.

MODEL SHOWS PROPOSED SAN DIEGO INTERCHANGE

A preview of the major interchange which, within a few years, will connect Interstate Highways 5 and 8 and State Route 109 near the old town section of San Diego has been on display in the lobby of the Title Insurance and Trust Company in downtown San Diego. Viewing the model are, left to right: R. F. Bachman, vice president and manager of the Title Insurance and Trust Company; District Engineer Jacob Dekema of District 11; and John M. Robinson, president of the San Diego Highway Development Association. The scale model, used in design of the complex interchange, was built by Division of Highways Bridge Architectural Section in Sacramento.

New Routings Adopted

At its March and April meetings, the California Highway Commission adopted the location for 66.5 miles of freeways on five routes; revised 3.6 miles of a previously adopted freeway routing; and adopted new alignments for 1¼ miles on two conventional highways.

Although all of the route adoptions were preceded by public hearings conducted by the Division of Highways, only one generated sufficient local interest to require a public hearing by the commission itself.

The adoption of a freeway routing for approximately 30 miles of Route 152 in Merced County, between its junction with Route 207 and the Madera county line, was the subject of a commission hearing in Los Banos on March 25.

The new routing generally follows the alignment of the existing highway except for a section of about five miles in and near Los Banos where it curves southeasterly near Los Banos Creek to cross Ortagalita Road, then swings easterly to pass south of the cemetery at Center Avenue.

It continues easterly to the Main Canal, then turns northeasterly to merge with the existing highway about one-half mile east of Ward Road.

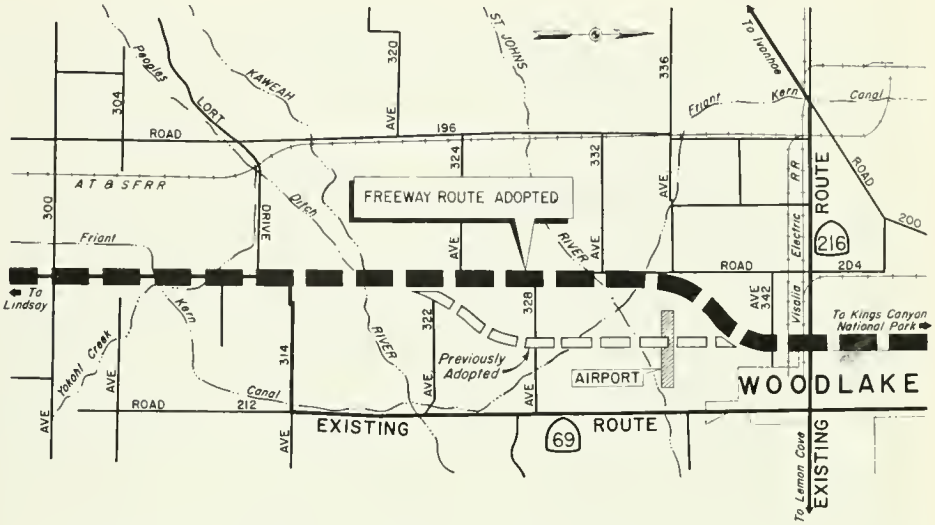
In San Diego County, the commission adopted freeway routings for 17 miles of Route 56, between Interstate 5 Freeway, now under construction north of La Jolla, and Route 67, northwest of San Vicente Lake; and for 2.3 miles of Route 54 between Interstate 5, just north of Chula Vista, and just east of Sweetwater Road.

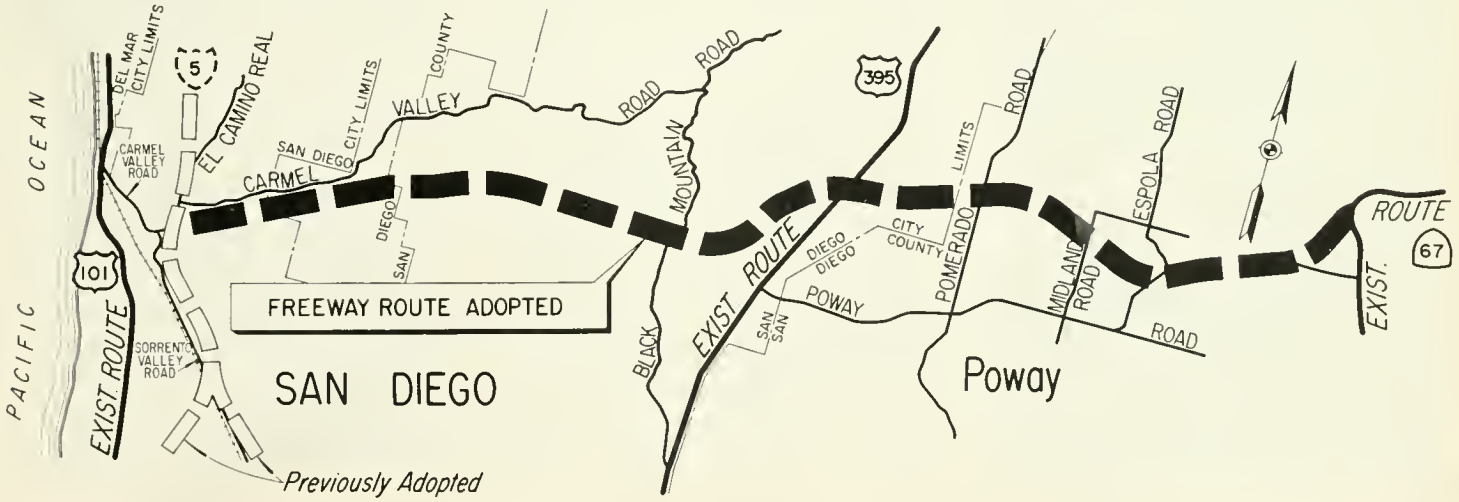
The Route 56 Freeway is planned as an integral part of the future San Diego metropolitan area freeway system, and is intended to serve the anticipated development between the coastal communities of Del Mar and La Jolla, and the inland communities of Poway, Ramona and Julian.

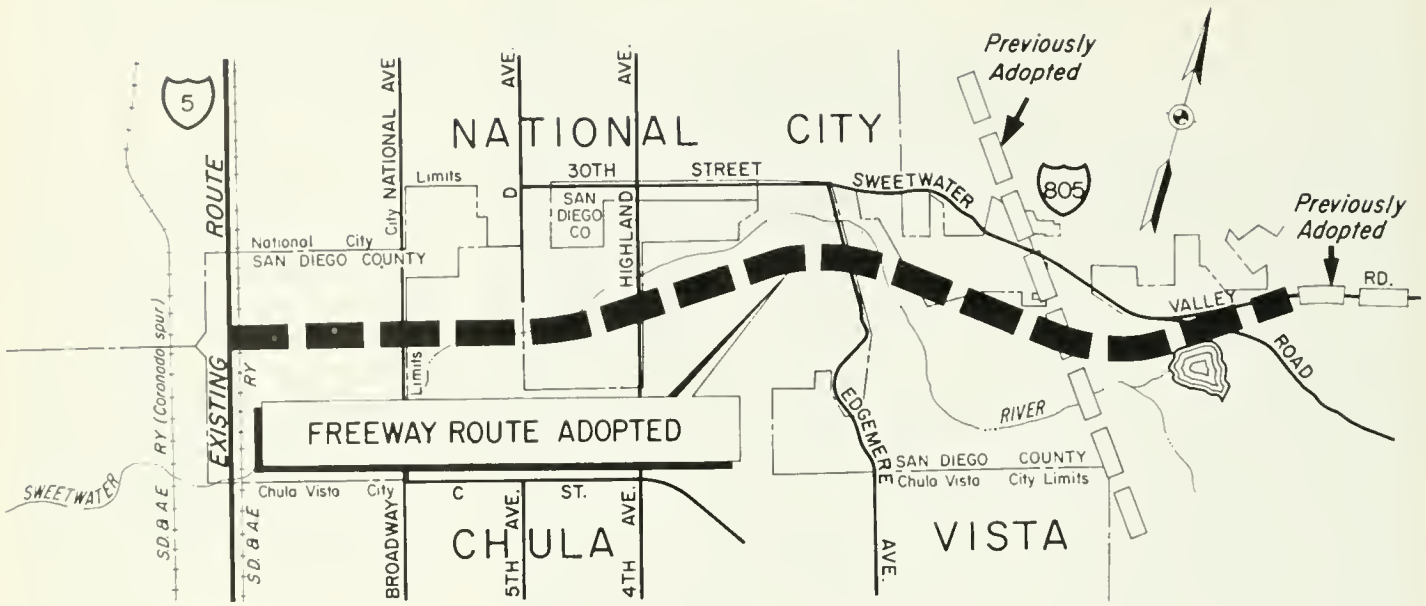
The Route 56 Freeway will run easterly from Interstate 5, just south of Carmel Valley Road, will cross US 395 about 1.5 miles north of Poway Road, and will intersect Route 67 about 0.8 mile north of Poway Road.

Route 54 will follow the center of the Sweetwater Valley easterly from Interstate 5 past Sweetwater Road to Valley Road, with a slight swing to the north in the vicinity of Edgemore Avenue. Near its easterly end the adopted route will intersect with the adopted routing for the Interstate 805 Freeway.

The commission adopted freeway locations in Santa Barbara County for 11.7 miles of Route 246 and 5.5 miles of Route 1.







The new alignment for Route 246 extends between Cebada Canyon Road, about three miles northeast of Lompoc, and 1.7 miles west of US 101 at Buellton. It generally follows the alignment of the existing highway except for a 2.6-mile section through the Santa Rita Hills east of Drum Canyon Road, where it will eliminate some curves.

The Route 1 Freeway will follow the alignment of the existing highway between 1.4 miles northwest of Orcutt and 3.5 miles south of Guadalupe.

The commission had adopted a 20.4-mile combined routing for Routes 65 and 69 in the Lindsay-Exeter-Woodlake area of Tulare County in January 1962. However, the City of Woodlake had requested that the adopted alignment be changed to avoid a private airport, approximately one mile south of the city, which Woodlake plans to convert into a municipal airport.

At its April meeting, the commission adopted a revised routing for a 3.6-mile segment which diverges from the previously adopted routing just north of the Kaweah River and continues parallel to and just east of County Road 204 to just south of Avenue 336. It then swings northeasterly, passing west of the airport, and rejoins the adopted routing at Avenue 342.

The commission also adopted new routings for short sections of two conventional highways.

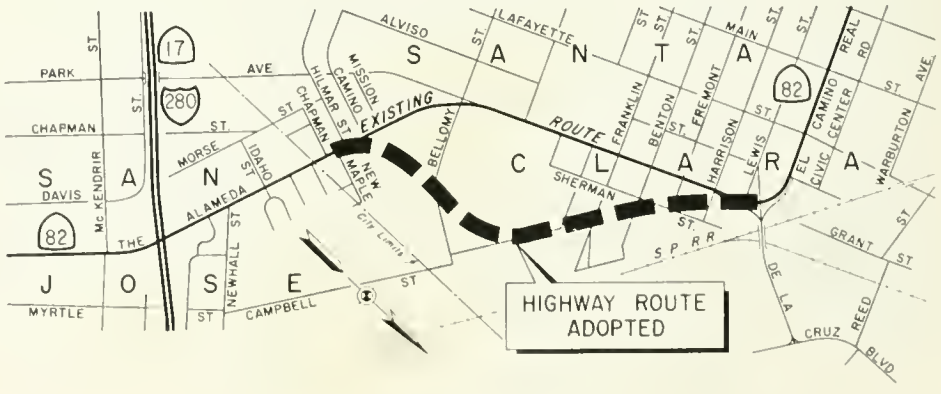
In Santa Clara County, it relocated one mile of Route 82 (El Camino Real) in the City of Santa Clara between De La Cruz Boulevard and New Maple Street.

The new route leaves the existing highway at De La Cruz Boulevard and runs southeasterly to Campbell Avenue at Franklin Street. It follows along Campbell Avenue to approximately 600 feet northwest of Bellomy Street, then turns southerly to rejoin the existing highway at The Alameda near the junction of New Maple Street.

Both the city and the University of Santa Clara had asked that the highway between these limits be rerouted, as it passed through the center of the university's property and the school's planned building expansion would increase the number of pedestrians crossing the highway. The city also stated that the rerouting would benefit a planned urban renewal area by removing through traffic.

In Humboldt County, the commission adopted a new routing for three-fourths of a mile of Route 36, about nine miles east of Carlotta.

The new routing straightens a curve along the north bank of the Van Duzen River around the low-lying flat known as "Stretter Ranch." The former highway was nearly completely destroyed by last December's floods.



Roadside Vegetation

Finding ways to maintain California's more than 14,000 miles of state highways efficiently, economically, and safely involves the design and construction of special equipment when items to fit these needs cannot be purchased commercially.

Recent innovations designed by the Equipment Department of the Division of Highways have resulted in two improved machines for roadside vegetation control.

The newly developed ice plant cutter, with blade encased for safety, trims vegetation with a minimum of manpower and traffic disturbance.

Cutter

One is a cutter which is similar to a lawn edger in purpose. The job of the cutter is to trim vegetation that has begun to creep over curbing and thus present an accident hazard. With more freeways featuring attractively planted medians and roadsides, efficient control of overgrowth has become an area of increasing concern.

A plant frequently used for ground cover is ice plant. Although its vines are thick and pulpy, have a high water content, and develop tough fibers, ice plant is one of the few carpeting plants suitable for use as ground cover in California. Over 90 percent of the world's plants have been ruled out for landscaping because all of the state, in terms of nature, experiences an annual summer drought.

The toughness of ice plant makes roadside cutting a difficult chore. Employees on foot were used for the job but hand cutting was time consuming and dangerous. A rotary disk-type cutter, mounted on a motor grader, was tried in early experiments, but was discarded because the round cutter did not trim well; its blade was easily dulled, and it was slow and expensive to operate.

The continuing need for a cutter led to the development of an edger using the principle of the rotary mower except that the blade is mounted vertically. The blade, a ⅜" x 2½" x 24" double-edged alloy cutter equipped with a safety guard, is powered by a hydraulic motor driven from the vehicle's engine. Mounted on a mower chassis, the machine can clear from three to five miles of roadside per hour, a considerable improvement over the one-mile-per-day accomplished by a man on foot.

On the test unit, the cutter blade was installed on only one side of the mower. Future models, however, will have blades on both sides so that both sides of the roadway may be cleared and the direction of travel will always be with traffic. The blade arm of the machine is retractable so that the vehicle need not impede traffic when being moved from job to job.

The first machine was tested in coastal areas where vegetation grows at a rapid rate. Even in this favorable climate, it has been determined that once a mowing schedule is established, new overgrowth can be cut approximately once a month by the machines, and the trimmings easily swept away with gutter brooms.

Spray Proportioner

A second unit, also developed for vegetation control, is used for roadside spraying of both herbicides and insecticides. Retarding growth is preferable to killing vegetation because of the undesirable appearance produced when growth is completely eliminated.

The development of a device for dispensing roadside chemicals was vexing for several reasons.

Ordinary agricultural type sprayers, which work well in fields away from traffic and close to a source of spray supply and water, did not fit the needs of the roadside vegetation control program. Ideally, a unit for use on highways would have a rapid working speed and also be able to travel at usual road speeds when enroute. Capacity would be such that refilling would be needed infrequently. Also, a successful machine would be able

This article appeared in the April 1965 issue of *Public Works* magazine and is reprinted here for the convenience of those who might not have seen it as originally published.

to cover 24 feet of roadside with one application, and could be operated by one man.

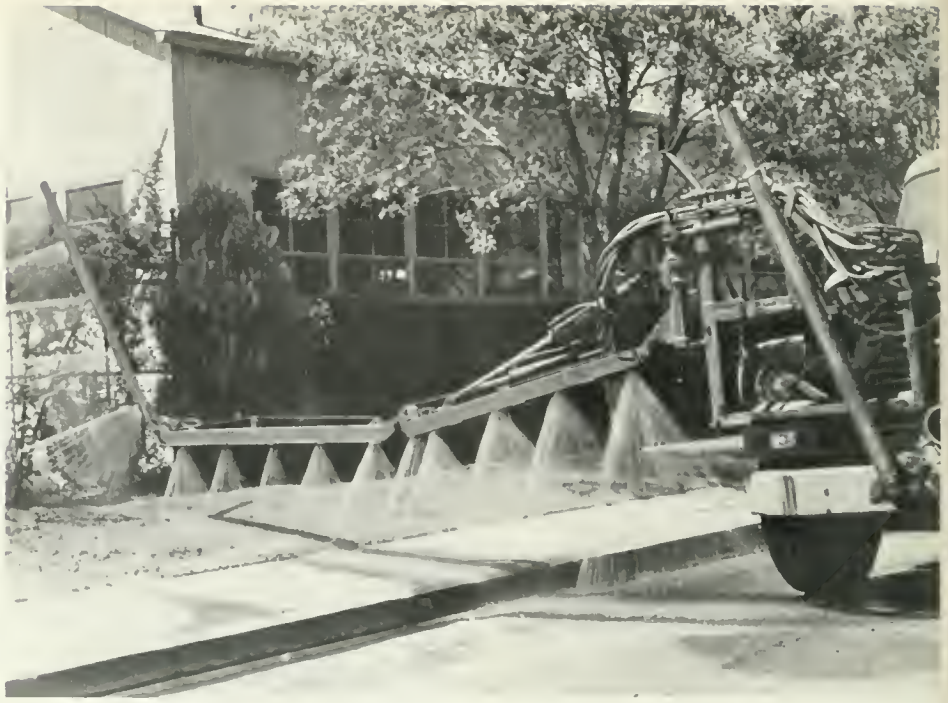
In the first experiment, a one-tank truck was used, but certain obstacles were encountered. Quantities of mixture which would be needed for a specific job were hard to estimate. Mixing the chemicals beforehand and loading them into the truck tank

A rear view of the spray proportioner truck shows the two oblong chemical tanks and the oval water tank. The rear steps are retractable.

proved slow and wasteful. Maintenance employees were often at a loss at how to dispose of excess material. Often, long trips were necessary to find a "safe" place to dump a potentially toxic mixture.

Moreover, many of the chemical additives caused the interior of the tank to scale and rust. The rust particles would then flow into the spraying apparatus, causing plugged filters and spray jets. Experiments with types of paints and lining materials to eliminate corrosion of the tank interior were ineffective. Steam cleaning of the tanks was often necessary when different chemicals were used.

A solution to the roadside spraying problem has been found in a recently developed machine called the "spray proportioner." Designed by the Equipment Department, the new sprayer has three tanks on one truck bed. The main tank, of oval configuration, holds a 2,000-gallon supply of water. (One hundred gallons of mixture are usually adequate for spraying one acre.) The



The versatility of the spray proportioner is demonstrated by this positioning of the three eight-foot hinged booms. The irrigation pipe, attached at the center of the truck bumper, is in its travel position.

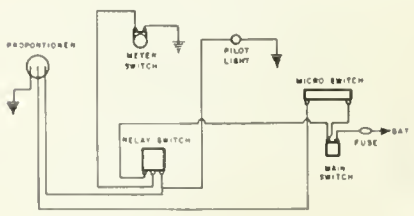
other two 60-gallon stainless steel tanks can be filled with chemicals to be mixed in any desired ratio. The new machine is also capable of varying flow rate and pumping pressure.

The spray proportioner can be used for irrigation as well as for spraying. A water delivery boom is attached to the main tank, enabling the operator to release pure water for trees and other vegetation. A power lift on the boom makes it possible to bypass signs and other obstacles which formerly slowed down operations.

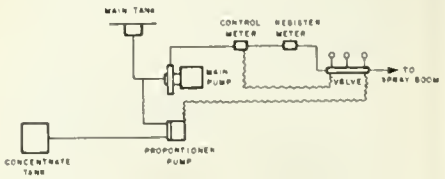
Clogging of jets does not seem to occur with the new method. On-the-spot mixing of chemicals reduces the potential for rusting, and pure water from the main tank can be used to flush the spray jets at the end of a job. Unused chemicals can be drawn off and stored, or left in the tanks for future use.

During vegetation and insect control operations, a second man is required to control the rate of application and manipulate the spray boom from the cab. The spray boom consists of three eight-foot sections, all individually actuated by electronic controls in the cab. When the equipment is in full use, the operator can spray a 24-foot-wide section.

The spray proportioner makes finite control of the spraying operation possible. This is highly desirable in cutting maintenance costs and keeping roadsides attractive.



WIRING DIAGRAM
PROPORTIONER



FLOW SYSTEM
PROPORTIONER

JAPANESE ENGINEERS VISIT HEADQUARTERS OFFICE

A group of Japanese engineers, contractors and highway officials visited California in late April to observe construction methods and confer with staff members of the Division of Highways. Those seated at the table in the Public Works Building conference room in Sacramento are members of the visiting delegation, as are the two men on the left of the group standing at the rear. The other five men standing are from the Division of Highways staff: left to right, James K. Okimura, structural draftsman; George W. Smith, senior bridge engineer; George Langsner, Deputy State Highway Engineer; J. C. Womack, State Highway Engineer; and H. Frank Hiyama, associate bridge engineer. The young lady is Miss Reiko Yabuno, tour coordinator.

Maintenance Chief Ralph Kinsey Retires

Ralph D. Kinsey, assistant district engineer, maintenance, in District 4, retired May 31, completing more than 41 years of service with the Division of Highways.

RALPH D. KINSEY

A native of Los Angeles, Kinsey attended school there, Fullerton and Monrovia. He joined the Division of Highways in 1924 as an instrumentman, grade 2, in Ventura County, at the start of the Coast Highway construction below Point Mugu.

After a short time on surveys, he transferred to construction in 1925, holding residences in the Los Angeles and San Diego areas until 1933. During that year Kinsey was assigned as design engineer in District 7, performing engineering duties in design and right-of-way engineering. In 1940, he was appointed assistant district maintenance engineer in Los Angeles. He held that post until 1945, when he came to San Francisco as maintenance engineer for District 4. He has been in that post since then.

Kinsey is a member of the American Society of Civil Engineers and the American Association of Public Works. He is also a Mason and a member of the Commonwealth Club.

He and his wife, Margaret, have two sons, William R. of Middletown, Ohio, and John of Temple City, and seven grandchildren.

Construction Costs Drop 6.9 Percent

The California Highway Construction Cost Index for the first quarter of 1965 dropped to 249.6 (1940 = 100), which is 18.5 points or 6.9 percent under the fourth quarter of 1964.

The number of bidders for this quarter averages 5.8 per project, an increase of 0.5 over the previous quarter.

District Eight's Wayne Crawford Retires

Wayne H. Crawford, construction engineer for District 8 in San Bernardino, retired in April after 35 years with the Division of Highways.

Except for short periods when he was on loan to the Bridge Department and District 3 in Marysville, all of Crawford's service was with District 8.

WAYNE H. CRAWFORD

He was resident engineer on many major highway projects including the units of the San Bernardino Freeway which included the 60-acre Route 26/43 interchange. He later held the posts of district materials engineer and district design engineer.

A native of Fort Wayne, Indiana, Crawford attended schools there and in Grants Pass, Oregon.

He began his engineering career as assistant to the city engineer of Covina and Glendora, California. Before joining the state in 1930 he was employed by the City of Los Angeles Colorado River Survey.

Crawford is a Mason and a member of the Al Malaikah Shrine.

He and his wife, Emagene, have a son, Wayne, Jr., who is a commander in the U.S. Naval Air Force.

IN MEMORIAM

District 5

Arthur F. Durrant, highway foreman.

District 7

Francis G. Parsons, associate right-of-way agent.

District 8

Curtis Lakes, highway maintenance man II.

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DALE DOWNING . . Bridge Engineer—Southern Area

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California Highway Commission—1965

This portrait of the California Highway Commission was taken during the April meeting in the conference room in Sacramento.

Chairman Robert B. Bradford, Administrator of the Highway Transportation Agency, is at the left. Continuing clockwise around the table: State Director of Public Works John Erreca, the commission's administrative officer; Roger S. Woolley, vice chairman; Franklin S. Payne; Joseph C. Houghteling; Commission Secretary A. J. Cooper; Assistant Secretary Robert T. Martin; State Highway Engineer J. C. Womack; William S. Whitehurst; Abraham Kofman; and James A. Guthrie.

The large aerial mosaic on the wall shows a portion of San Francisco, in connection with the commission's consideration of a routing for Interstate 480 in that city.

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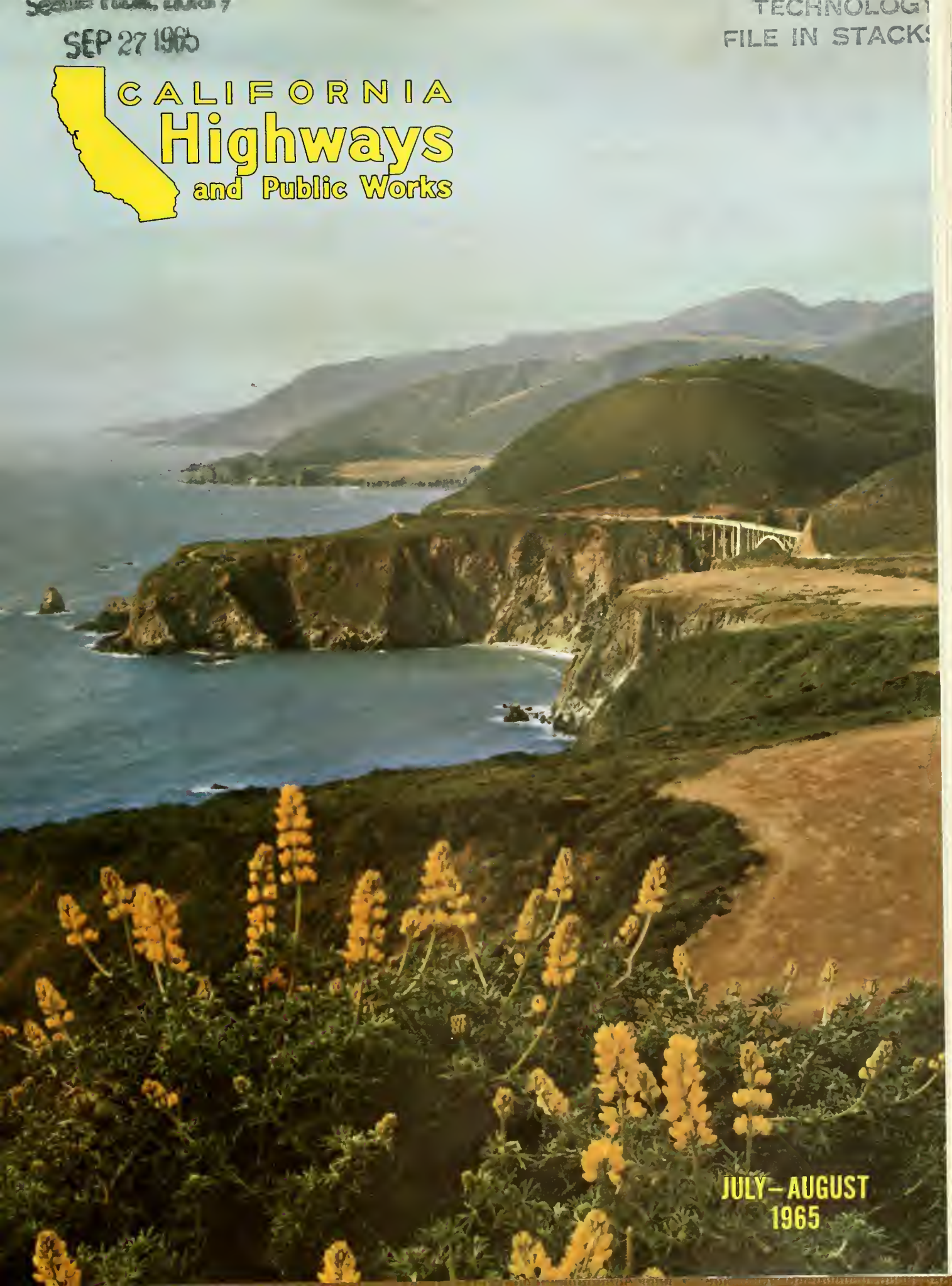

JULY–AUGUST
1965

First 'Scenic Highway' Unit

California's first officially designated "Scenic Highway" includes this section near the Big Creek Bridge, south of Big Sur.

State Director of Public Works John Erreca has declared Route 1 in Monterey County, between the San Luis Obispo county line and Carmel River, to be the first officially designated unit of California's state scenic highway system.

His declaration followed the unanimous recommendation of the State's Advisory Committee on the Master Plan for Scenic Highways.

California's Legislature has pioneered the concept that a state be concerned with the preservation of the scenic values visible from its highways, Erreca said. Investigations into the planning, design, and conservation problems associated with the development of a statewide system of scenic highways were ordered in 1960, and a master plan for such a network was adopted in 1963.

The 1963 lawmakers decreed that "scenic highways" must fulfill the requirements of other routes in the state highway system; traverse areas of outstanding scenic beauty; and in location, design and construction receive special attention in terms of impact on the landscape and visual appearance.

Erreca added that the designation of official scenic highways depends, among other criteria, upon local governing bodies studying the scenic corridors along the motorists' line of sight, and passing appropriate zoning and other regulations to insure that the attractiveness of these corridors will be preserved.

The 72-mile stretch of Route 1 along the Pacific Coast was the subject of the pilot study authorized in 1960 by Senate Concurrent Resolution 26, sponsored by Senator Fred S. Farr of Monterey County.

"This start in officially adopting routes in California's scenic highway system is particularly timely," Erreca said, "following as it does the White House conference of last month on natural beauty."

California Highways and Public Works

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VOL. 44 July-August Nos. 7–8

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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SACRAMENTO, CALIFORNIA 95807

FRONT COVER: California's first stretch of officially named "Scenic Highway" includes this portion of Route 1 on the Pacific Coast where this spectacular bridge crosses Bixby Creek. The segment of highway first designated goes through Big Sur country in Monterey County, from the Carmel River to the San Luis Obispo county line. See story on inside front cover. (Photo by Robert Mulno.)

BACK COVER: Caldecott Tunnels, heavily traveled by commuters from Orinda and Walnut Creek, now number three with the completion of the newest bore. The interior of the third tunnel is well illuminated and well ventilated. Operations are directed by remote control. See "The Caldecatt Tunnels," page 12. (Photo by Pete Asano.)

Pacheco Pass

Route 152 Now Skirts San Luis Reservoir Site

By R. B. "BUD" WEAVER, Resident Engineer

The new 12-mile section of Pacheco Pass, Highway 152, around the north portion of the San Luis Dam and Reservior was opened following ribbon-cutting ceremonies on April 29, 1965. The contract for this project was completed with only 530 working days used of the 640 days allotted. The completion of this $12,000,000 project in record time is attributable to the mutual cooperation between the contractor, a joint venture by McNamara and Mannix, the U.S. Bureau of Reclamation, the State Department of Water Resources, and the Division of Highways.

The timing of this enormous project was critical, due primarily to the dam construction. Work started in February 1963, and shortly thereafter double shifts were employed by the contractor to provide for the completion of one lane of traffic in each direction by January 1, 1965. This was necessary in order to move the traffic from the old Pacheco Pass Highway, which will be inundated by the reservoir, onto the new road to permit the completion of the San Luis Dam. It was essential to keep this route open since it is the main connecting link between the Santa Clara and the San Joaquin Valleys.

The Challenge

The difficulties described in the March–April 1963 issue of *California Highways and Public Works* during the design stages of this project were almost eclipsed by the problems encountered during construction.

The contractor scheduled his operations to move 11,400,000 cubic yards of dirt and rock in time to complete the entire project by January 1, 1965. This required an average production of at least 27,000 cubic yards of excavation per day. Maximum production could not be obtained until access roads were constructed and drainage structures under the major fills were completed. A maximum of 100 earth-moving units were used to complete the grading on schedule, reaching a peak efficiency of over 40,000 cubic yards per day in moving the last 7,000,000 cubic yards.

This high-production operation compounded such problems as scheduling the employees of the state and contractor on double shifts, communications between the various units, field offices and laboratories; and maintenance and servicing of equipment, which was in constant use nearly 20 hours a day. The grading operations were frequently going on at the same time over the entire 12-mile length of the project and two-way radio communication was a requisite. Access to some of the job areas was by "cow trails," with high-clearance, four-wheel-drive pickups used to transport inspection and construction crews.

Water Supply

The contractor's first major problem was to find water for the project. This problem was solved by pumping water from the Delta Mendota Canal through pipelines to a reservoir near the center of the project. Feeder lines were then run from this reservoir to points along the new alignment where water was required for the easterly half of the project. Electric pumps were used to fill a pond about three

Looking west where drivers are provided an area to check their trucks at the summit of the Pacheco Pass Highway near the Santa Clara-Merced county line.

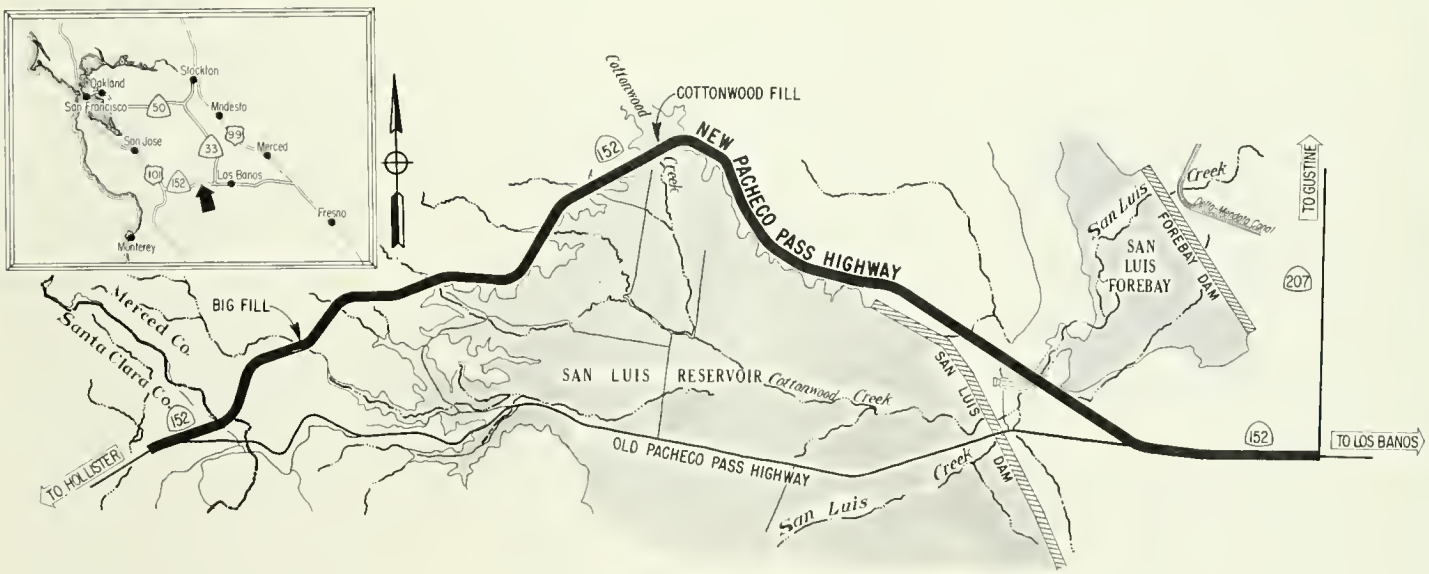
When filled, the San Luis Reservoir will have water on both sides of the "Cottonwood Fill" shown in the foreground.

miles west of the reservoir and diesel pumps boosted the water from the pond over the higher elevations to provide water for the westerly half of the project. Twenty miles of pipe were eventually installed to provide water for the entire project.

Supplying compaction water for fills in steep draws was a constant problem. This was solved by running "Rainmaker" pipe to the fills and applying the water with "monitors." The "monitors" were used until conventional water trucks could be economically used to water the fills.

Earthwork

Grading operations overshadowed many of the interesting and challenging problems experienced on this project. Each cut presented a different problem. Fault planes were found to be adversely tilted, thus preventing the construction of some of the planned slopes. The type of material was constantly changing; rock cuts turned to dirt; and dirt cuts turned to rock. These conditions taxed the ingenuity of the contractor in selecting the right equipment to do the best job.



This map shows the limits of the San Luis Reservoir and the new location of Route 152.

Compaction tests were performed at night to help meet the time limitation on the project.

Above—Bin wall is constructed to contain fill slope in a steep canyon. Below—Drilling operations in the foreground coincide with rock loading by a huge power shovel onto dump trucks in background.

This arch structure now rests under 2,000,000 cubic yards of dirt required for the "Big Fill."

A 10-foot-high arch is now about 200 feet below the roadway. A fill was required to maintain the steady grade now experienced by motorists.

Grading began with a spread of scrapers; however, it was soon found that this equipment could not economically and efficiently move the various materials found in the strata encountered. Therefore, a sequence was established that was found to be successful and was continued for the remainder of the project. Cuts were started with scrapers, which were used until the fills became accessible for the movement of rock trucks. The trucks were then brought in and loaded with belt loaders which were fed by bulldozers. After about 30 feet of cut was removed, the belts would be lowered, and the operation repeated until the cut was completed. The slower shovel work was confined to the rockier cuts.

Since such large amounts of excavation required blasting, oversize 4½-inch and 6-inch drills were used for the drill holes to enable placing a greater explosive charge. Potential damage to trees and cabins was not a factor, since they were nonexistent in this area. This made it possible to use larger amounts of explosives to speed the work.

Landslides were a continuous problem throughout the entire length of this project. At the beginning, the landslides seemed of little consequence and the problem was solved by removing only that material which has been dislocated by the slide. As work progressed, however, it became necessary to institute other measures to cope with difficult areas. Where it was possible, slopes were flattened by eliminating benches and using all the available right-of-way. However, at several locations, it was not feasible to flatten the slopes due to the steep terrain. In these areas the centerline was moved downhill, thus permitting flatter slopes without substantially increasing roadway excavation quantities.

Almost a million cubic yards of dirt were moved from the slide areas where the cut slopes were flattened to provide for more stability. In many of the cuts, unusual water problems were encountered, requiring the installation of horizontal drains, deep transverse cutoff trenches, stabilization trenches, and permeable blankets.

Structures

Constructing large reinforced concrete arch drains and building twin bridges in such inaccessible locations posed unusual forming and placement problems. These large drainage facilities had to be completed before the fill operations could begin at maximum production.

The larger arches (9 and 10 feet) were constructed with adjustable steel forms to accommodate both sizes, whereas the forms for the smaller arch (six feet) were built on the jobsite. A 1,042-foot-long arch (nine feet) under the 280-foot-high fill was constructed so that the center 625 feet of the arch was extra strong to withstand the tremendous earth pressure. The 560-foot-long bridges were built over the channel leading into the San Luis Forebay as separate structures.

All of the structural materials with the exception of concrete sand were obtained from or near the jobsite. Concrete aggregates were produced using materials from within the work area. The sand produced locally was not satisfactory for concrete, but it was used to blend with aggregates to make subbases, bases and cement treated base. Aggregate subbase was obtained from the conglomerate highway cuts and was processed by screening. Pervious material was also obtained by selection within the conglomerate cuts. Coarse aggregates for both base on portland cement concrete paving were produced from the same material site located in the future reservoir area near the jobsite, and methods of processing were adapted to maintain the proper respective quality controls.

Paving Operations

Almost a half a million sacks of cement were used in placing the 370,000 square yards of concrete pavement for this project. Concrete pro-

Twin bridges cross the San Luis Forebay channel. The roadway under the bridge will be inundated when heavy equipment used to construct the dam is no longer needed.

A peak is leveled and a canyon filled. Heavy equipment takes a beating in this rough terrain.

ducing operations were a modification of central mix in which the contractor split his batching and mixing operations. The batch plant was located adjacent to the aggregate production plant and batches were weighed and loaded into bottom dump trucks and trailers; one batch filled the truck and the other, the trailer. At intervals, the mixer was moved from location to location immediately adjacent to the roadway where the cement and water were added and the mixing operations performed.

This type of operation was required because of the length of the project and the hauling conditions involved. It was a very efficient way of placing the concrete pavement and meeting the specification time requirement.

Plant-mix cement-treated base was mixed in a plant fed by belt scales. This technique provided an excellent plant control of the quantities mixed, as all ingredients were proportioned by weight.

The cement-treated base was placed with a modified slipform paver which produced a well-controlled finished product. Trimming was nominal and the close tolerances secured in the placement of the cement treated base were reflected in the ease of thickness control of the portland cement concrete pavement.

The contractor was represented by C. A. Peterson, general manager; L. E. Christman and M. L. Shank, project managers; and the author was the resident engineer for the state.

Other Projects

Construction was recently completed on a new four-lane stretch of Highway 152 which ties in with the east end of the Pacheco Pass Highway and extends easterly about two miles to Highway 207. The completion of this project provides a four-lane divided expressway from west of the Santa Clara county line to five miles west of Los Banos.

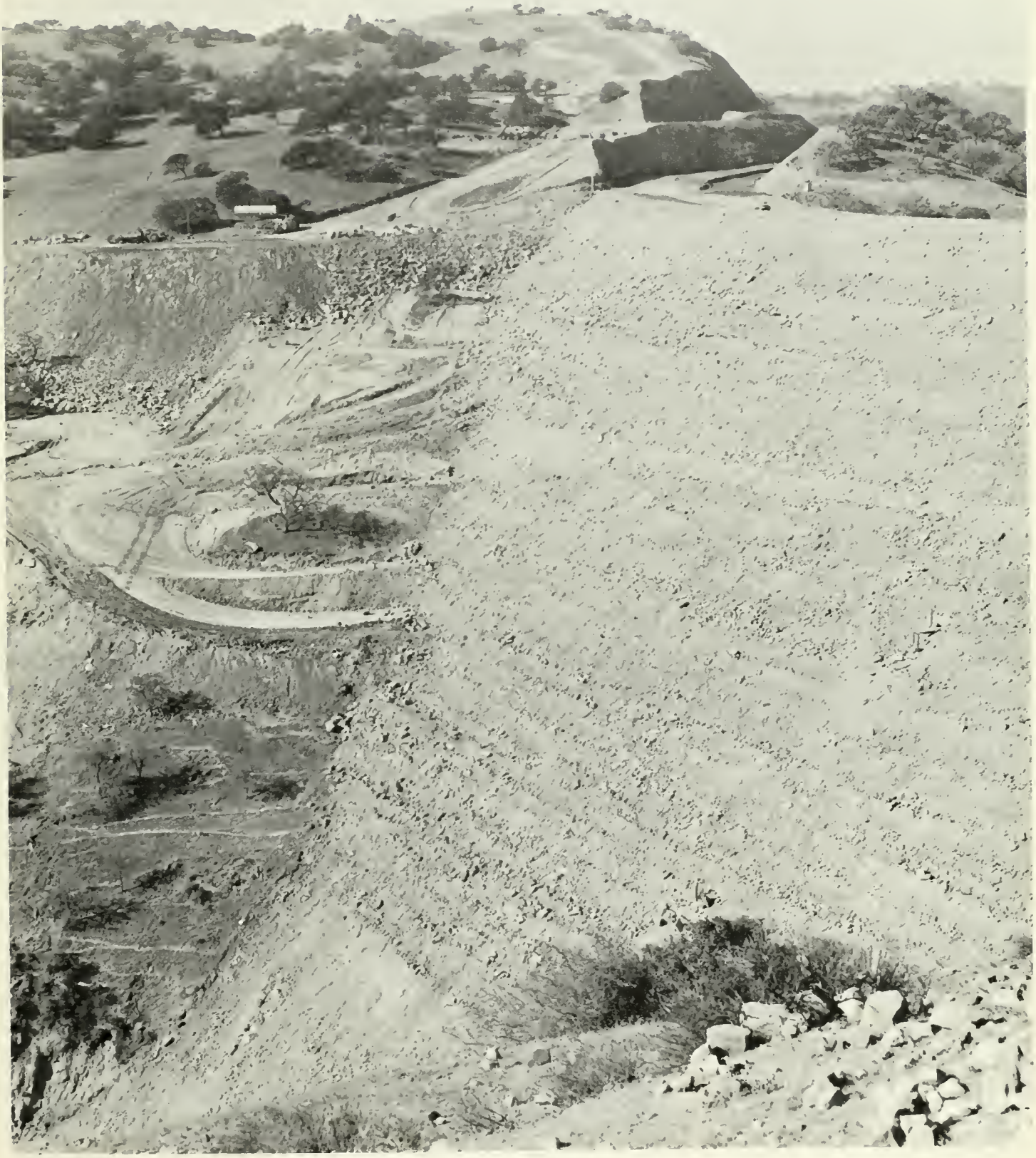
A portion of Highway 152 was improved in Los Banos when construction was completed this spring by widening a former two-lane section of highway to four lanes.

Future Planning

Highway 152 between Highway 207 and US 99 is ultimately to be improved to bring it up to four-lane freeway or expressway standards.

Although design and right-of-way acquisition work is progressing steadily and surveying and aerial mapping is being performed at various locations on Highway 152, construction of these projects will depend upon the future availability of funds.

The "Big Fill" is over 280 feet high and the "Big Cut" is over 300 feet deep.



At rough grade level, the "Big Fill" dwarfed the car at the top right.

Safety Roadside Rests

By G. A. HILL, Assistant State Highway Engineer (Planning)

Although there was no formal ceremony, the State Division of Highways has dedicated its first complete safety roadside rest to a familiar American figure—the weary motorist.

This first fully developed haven for the leg-stretcher and scenic admirer is located on Interstate 5, about five miles north of Red Bluff. Led to the site by a blue sign which hints of a peaceful place in which to shake off the strains of driving, the motorist can actually encounter two similar areas, depending on whether he is northbound, southbound, or making a round trip. This will be the general plan for all rest stops located on heavily traveled divided highways.

Although not intended for overnight stops, the roadside rest provides all the facilities of a well-developed park. There are comfort facilities, a drinking fountain, picnic tables, and stretches of black-topped sidewalk for a pleasant meander through the area to remove those driving kinks.

The buildings are designed to complement the natural setting. In the case of the Red Bluff stop, adobe-style concrete blocks and shake roofing are the materials used. Inside, ceramic tile walls and foot-operated facilities, help insure a clean and sanitary atmosphere.

Cost of this pair of roadside rests was $80,000. Others will range from as little as $5,000 to as high as $100,000, depending on their size, the facilities provided, the terrain and other factors.

For economy, most safety roadside rests, are being built in conjunction with highway construction projects. During the current fiscal year 12 roadside rests are provided for in this manner in the state highway construction budget. Most of the initial rest areas are being placed on interstate routes as an authorized part of this national interstate and defense highway system.

Eventually, California expects to have approximately 250 sites developed into safety roadside rests, and they will supplement other facilities to provide a stopping opportunity at about half-hour intervals of driving time.

On the outskirts of major metropolitan sections there will be stopping points with a function beyond that of the usual rest area. Designated as map inspection points, these roadside rests will provide a convenient stopping place for travelers bound for densely populated areas. It is hoped that they will stop, consult their maps, and plot their courses via freeways and city streets to their desired destinations within large cities.

The Division of Highways has been in the safety roadside rest "business" since 1963. Prior to that, a limited program had been carried out by the California Division of Beaches and Parks. The 11 roadside rests which were constructed under this earlier program have now been transferred to the Division of Highways, and those which lacked complete facilities are gradually being upgraded as programing and funds allow.

Following is a list of the current status of the 44 roadside rests and map inspection stations completed, being constructed, or budgeted under the Division of Highways program:

Del Norte County—US 199, at south portal of the Collier Tunnel, three

Once within the confines of the roadside rest area, it is difficult to tell that an interstate route is only seconds away.

miles south of the Oregon state line. Under construction.

Trinity County—Route 299, five miles south of Weaverville; originally a Beaches and Parks facility. Open.

Shasta County—Route 299, 38 miles east of Redding; originally a Beaches and Parks facility. Open; all facilities, but no water supply.

Lassen County—US 395, 12 miles south of Ravendale; originally a Beaches and Parks facility. Open.

Lassen County—Route 44, 28 miles northwest of Susanville. Budgeted.

Plumas County—Route 70, 46 miles east of Quincy; originally a Beaches and Parks facility. Open; all facilities, but no water supply.

Tehama County—Interstate 5, pair, north of Red Bluff. Open.

Glenn County—Interstate 5, pair, approximately two miles south of Artois; under construction.

Nevada County—Interstate 80, pair, near Donner Summit. Open; with comfort facilities to be added shortly. (The state opened bids on the project July 28.)

Amador County—Route 88, four miles west of Jackson, originally a Beaches and Parks facility. Open; but no water supply.

Calaveras County—Route 49, seven miles south of San Andreas; originally a Beaches and Parks facility. Open, but no water supply.

Calaveras County—Route 49, four miles south of Angels Camp; originally a Beaches and Parks facility, Open, but no water supply.

Stanislaus County—Interstate 5, pair, near Arkansas Fan south of the San Joaquin county line. Budgeted.

Merced County—Interstate 5, pair, near the San Luis Dam near Los Banos. Under construction.

Mariposa County—Route 140, eight miles east of Mariposa; originally a Beaches and Parks facility. Open, but no water supply.

This aeriol view of the safety roadside rest for northbound traffic on Interstate 5 neor Red Bluff shows the ease with which the motorist con leave the highway for o rest period. Blue Tent Creek is ot right. A similor oreo for southbound troffic exists to the north of this site.

Inyo County—US 395, near Haiwee Reservoir, constructed by Inyo County and deeded to the Division of Highways. Open; all facilities.

Inyo County—US 395, near Division Creek north of Independence. Budgeted.

Tulare County—US 99, pair, five miles north of Tipton. Under construction.

Kern County—Interstate 5, near Lebec. Open, but no comfort facilities.

San Bernardino County—Interstate 15, three pair, all located east of Barstow. All open. Two pair have comfort facilities under construction; at the remaining pair these are scheduled for later construction.

San Bernardino County—Interstate 40, three, located between Needles and Barstow. Originally Beaches and Parks facilities. Open, but no water supply.

San Bernardino County—Interstate 40, pair, near Desert Oasis east of Newberry. Budgeted.

San Bernardino County—Interstate 10, near Fontana. Map inspection station. Under construction.

San Bernardino and Riverside Counties—Interstate 10, pair, between Redlands and Beaumont. Open. Comfort facilities in planning stage.

Riverside County—Interstate 10, pair, 15 miles east of Indio. Under construction, with comfort facilities to be added later.

Los Angeles County—Interstate 5, near Castaic. Map inspection station. Under construction.

San Diego County—Interstate 5, near Leucadia. Map inspection station. Under construction, but no restrooms.

Imperial County—Interstate 8, 20 miles west of the Arizona border. Open, but with comfort facilities to be added in future when traffic circulation plan is revised.

Another law which is related to the roadside rest program is the Westside Freeway Park and Development Act of 1963 which provides complete integration of recreation features along the Westside Freeway. Skirting the western edge of the San Joaquin Valley, this completely new freeway (to be part of Interstate 5) will feature both roadside rests and roadside parks. The Legislature, in the 1963 law, stipulated that pairs of roadside rests were to be constructed at six locations between the San Joaquin River in San Joaquin County and the junction with US 99 south of Bakersfield in Kern County. Two of these roadside rests are now under construction (see listing for Merced County) and two additional rest areas will be constructed in Stanislaus County under a project to be advertised later this year (see listing for Stanislaus County).

The roadside park sites along the Westside Freeway will be located at five scenic areas—at the Kern River, south of Kettleman City, at Mercy Springs Road, at Orestimba Creek and at the San Joaquin River near Mossdale, and will be constructed under the supervision of the California Department of Parks and Recreation.

Safety roadside rest areas throughout California are really as different as the terrain in which they are built. One can see a spectacular contrast between the pair on Interstate 80 near Donner Lake (above) and the pair which flanks Interstate 15 east of Baker (below).

Last Bond Issue

On July 2, 1965, the State of California made the final payment on the last of its three highway bond issues.

The checks mailed by State Treasurer Bert A. Betts represented the last $1,000,000 in payments on the principal, plus $22,500 in interest. The total interest payments on the $40,000,000 issue have amounted to $44,950,077.

Voted by the people in 1919 and issued in 1920, this issue was the third of its kind approved by Californians to finance a highway construction program and "get California out of the mud."

In 1909 the California Legislature authorized and in 1910 the people approved the state's first highway bond issue of $18,000,000, but only by a small majority.

Even after a statewide campaign featuring photos of autos mired in deep mud on rural roads, etc., the bonds received only 93,297 yes votes against 80,509 no votes. Once passed, the issue, which bore 4-percent interest, proved hard to market. Only $4,280,000 could be sold publicly. The remainder were purchased by the counties "because," according to the Highway Commission's first biennial report (1918), "otherwise the work could not have gone on."

In spite of its unenthusiastic reception, the bond issue did make possible the real beginning of a unified system of state highways.

The act provided that a system should be acquired and constructed by the Department of Engineering and the routes selected and laid out "so as to constitute a continuous and connected state highway system running north and south, traversing the Sacramento and San Joaquin Valleys and along the coast by the most direct and practicable routes connecting the several county seats and joining centers of population, together with such lateral roads as might be necessary to connect the north and south arterials with the county seats lying east and west of such highways and also to connect the chief transcontinental routes entering California."

Governor Hiram W. Johnson summed up the problem when he told his newly appointed State Highway Commission that "you are expected to build with $18,000,000 a highway system that some of the best engineers have estimated will cost from thirty-five to fifty millions."

The state made the final payment and closed out the 1909 bond issue in July 1961 (see July–August 1961 issue of *California Highways and Public Works*, page 61). Total interest paid to the holders of these 50-year bonds was $18,061,641.

With the prospect of the 1910 funds being almost expended, the 1915 State Legislature authorized a second bond issue of $15,000,000. This was ratified by the voters in 1916 and issued in 1917. That California had become fully highway-conscious is attested by the fact that not a single county voted against the issue. The total was 542,239 in favor and 137,107 against.

Final payment on the 1915 bonds was made in July 1963, with a total of $16,172,213 being paid in interest to bond holders during the 45 years the issue was outstanding.

An indication of how the highway program was progressing is shown by the 1917–1918 biennial report, which reports that by June of 1916 a total of 1,263 miles of road had had work done on them including 323 miles graded but not yet paved.

At a special election on July 1, 1919, the people of California approved by 196,084 to 27,992 a third highway bond issue, for $40,000,000. These funds became effective immediately and provided for continued construction of the highways designated by the two previous issues. Under the third issue, additional roads were made a part of the state highway system.

This was to be the last of the highway bond issues. In its biennial report for 1919–1920, the California Highway Commission recommended creation of a gasoline tax, the proceeds of which should be "devoted solely to highway purposes."

The gas tax became a reality in 1923. That same year the Department of Public Works and the Highway Commission were reorganized, giving greater status to the latter as well as to the State Highway Engineer, who became executive officer of the commission and in direct charge of all highway construction. But in spite of California's now long-established pay-as-you-go policy which, through the gasoline tax and other highway user levies, has financed the construction of what is generally considered the most advanced system of freeways and highways in the world, the people of the state will always owe a debt of gratitude to the first three bond issues initiated by the state, meager though they seem by present standards, for they launched California on an integrated program of highway construction.

BYLINE OMITTED

Readers of the article on the Mission Gorge Road project in the May-June issue of this publication were probably baffled by the reference on page 19 to "the writer" of the article, not otherwise identified.

There should have been a byline at the head of the article reading: "Paul A. Hanssen, surveyor — road department, County of San Diego." Mr. Hanssen was one of the resident engineers on the project and prepared the article.

Seattle Public Library
SEP 27 1965

The Caldecott Tunnels

By IRWIN W. BLACK, Bridge Resident Engineer, and
ORIS H. DEGENKOLB, Bridge Design Engineer

Looking east at the newly completed third tunnel (at left) which facilitates progression of traffic through the Berkeley Hills on Route 24. Site of 1904 tunnel seen on facing page is now closed and completely covered over by foliage.

To the average motorist a tunnel is merely a hole through a mountain which provides a shortcut for the highway to get from one side to the other. But the amount and complexity of equipment and the numerous details which are required to design, construct and operate a modern highway tunnel quickly negate thinking of such passageways in simple terms. Highway standards are constantly upgraded, and tunnels too must be built to accommodate increased numbers of faster moving vehicles and provide the traveling public with safer, better ventilated, better lighted and more spacious appearing tunnels. Construction problems and costs rise rapidly as the size of a tunnel increases.

First Tunnel

The first highway tunnel through the Berkeley Hills between the City of Oakland and Contra Costa County was constructed in 1904. It was timber-lined, dark, narrow and only 1,000 feet long. Of course, the increase in population in this area and the increasing popularity of the automobile rendered this first crude facility inadequate in the early 1930's.

On December 5, 1937, appropriate ceremonies were held to dedicate the Broadway Low-level Tunnels and celebrate their opening, thus breaching the natural barrier to traffic. That event was the culmination of years of dreams, planning, and construction under the auspices and guidance of Joint Highway District 13, with the late Thomas E. Caldecott, president to its board of directors. Subsequent recognition has been given to Mr. Caldecott's vital role in this intercounty facility by rededicating the tunnels in his name and honor.

The twin tunnels, each 3,000 feet long, were concrete lined, lighted with incandescent electric lights and ventilated with a forced air ventilation system. Since these two tunnels were curved at the ends and joined one another at a single portal building at each end, many people have been led to believe that there is only one tunnel with a thin concrete wall separating the two roadways, but the roadways are 150 feet apart except at the curves at each end. Each of the twin tunnels has a 22-foot-wide roadway and a width of 26 feet 8 inches between the sidewalls. The original 1904 tunnel has been abandoned and the ends are closed.

Need for New Bore

Continued growth of the bay area increased traffic in the two low-level tunnels to the point where they were becoming inadequate. The need for a third tunnel to supplement the first two was the natural solution. Modern standards required that the highways at each end of the tunnels be widened and straightened and that the third bore be made wider than the first two. Since the third tunnel was to be considerably larger than the two older tunnels, it was not possible to adapt the original plans to the new location.

On October 6, 1964, dignitaries from throughout the area assembled to dedicate Tunnel III to the name and further honor of Thomas E. Caldecott. Mrs. Caldecott and her family were present on this occasion, which coincided with National Highway Week—1964.

New Features

The third tunnel has a 28 foot wide roadway and is 34 feet 6 inches wide between the sidewalls. The vertical clearance is 17 feet above the pavement, compared with the 14 feet 10 inches in the two older bores. In addition to the larger size of the tunnel itself, there are numerous other features which are new or improved. The entire length of the roadway is illuminated by a continuous line of fluorescent lights on each side of the ceiling. Extra lights are placed for a distance of 300 feet at each end so that there is a gradual transition in the daytime in order to allow drivers' eyes to adjust to the change from the bright sunlight outside and the artificial light in the center of the tunnel. Emergency power facilities have also been installed for use in the event that there is a power loss from the serving utilities.

Ventilation

A new transverse system of ventilation is being used. Fresh air is taken in at the westerly portal building and carried along a duct above the roadway. It is discharged into the roadway section through openings at one side of the ceiling. The fresh air mixes with exhaust fumes from the vehicles, and is drawn out through exhaust ports on the opposite side of the ceiling, then carried to the westerly portal building and discharged straight up into the atmosphere. The two fresh air and two exhaust blowers have a capacity of a half-million cubic feet of air per minute. The exhaust air is tested continuously (automatically) for carbon monoxide content. If the sampling indicates that there is a specified concentration of carbon monoxide accumulating, the ventilating machinery will automatically start to speed up until the concentration lowers to a desired level.

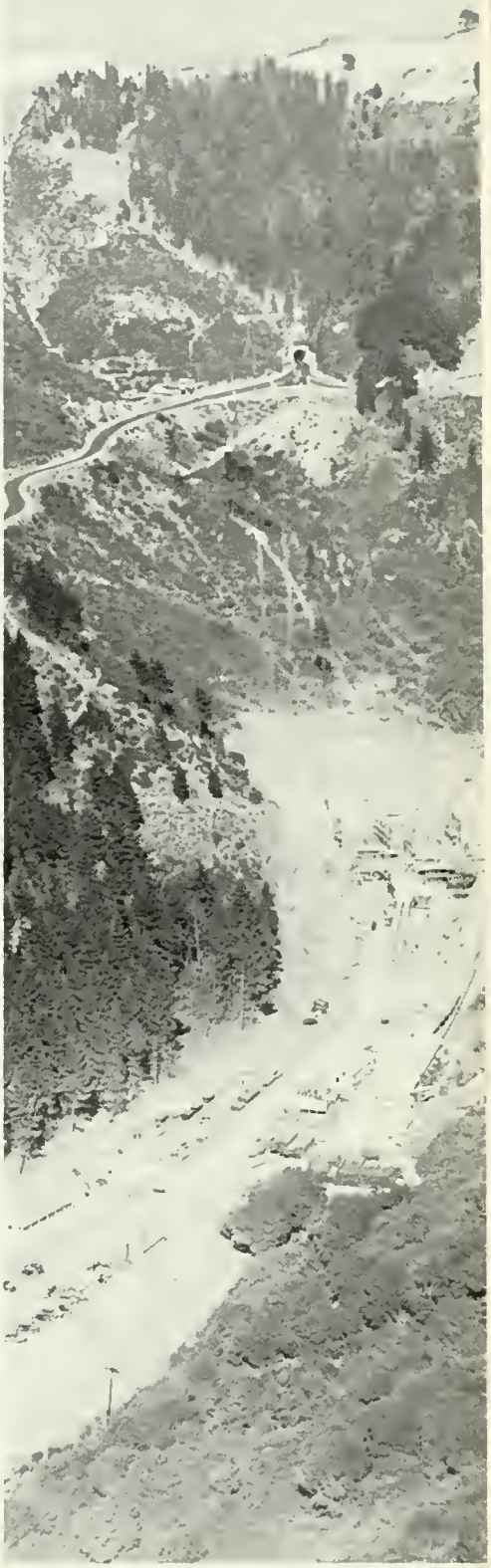
Other Equipment

Telephones, fire hydrants, and extinguishers are located at 250-foot intervals along one side for emergency use. The fire alarm systems will notify the fire departments from Oakland and Orinda (at opposite ends of the tunnel) in case of emergency. A public address system has been installed and can be used to give instructions to motorists in case of emergencies. An intercom system connects all working locations so that workmen and tunnel operators can communicate quickly.

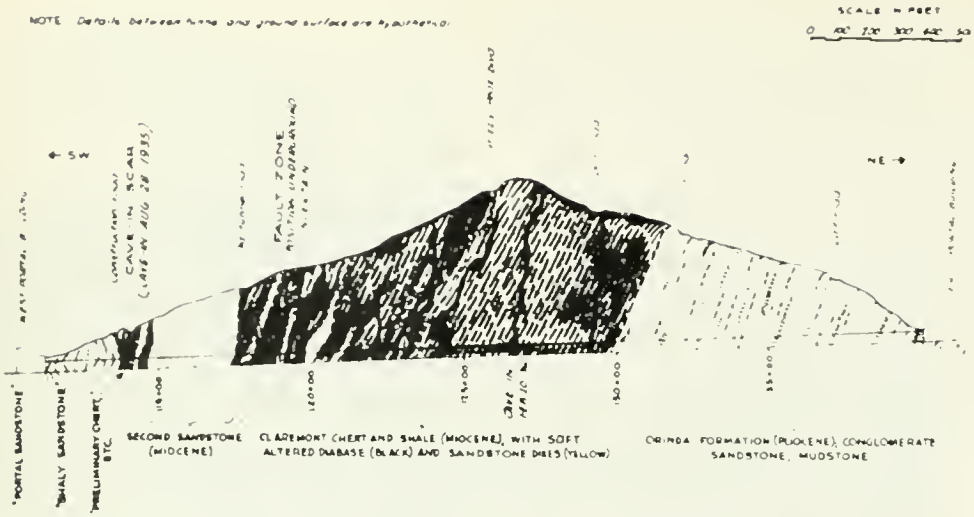
Television cameras are placed above each portal and are remote controlled so that the tunnel operators can detect difficulties or accidents. Provisions have been made so that TV cameras can be placed inside the tunnel at a later date for more thorough observations.

Preliminory Work

One of the most important factors in the design of a tunnel relates to geological conditions. A very comprehensive geological report had been made during the construction of the first two bores. This report was used later by the designers of the new tunnel and was also made available to the contractors who bid for its construction. Since the design of the existing tunnels had been proven to be structurally adequate by the test of time, various combinations of load-



Token September 1, 1934, this photogroph shows construction on the first low-level tunnels as well as the old tunnel (ot top center) built ot the turn of the century.



GEOLOGIC SECTION ALONG NORTH TUNNEL

ings considered necessary for the new tunnel were applied to the original designs.

Several Projects

The contract for construction of Tunnel III, approximating $11,000,000, was only one of several major projects completed, presently underway, or contemplated the facilitate the movement of traffic to and from central Contra Costa County through north Oakland.

Before actual tunnel work could start (November 1961), a first phase beginning December 14, 1960, included extensive drainage work and excavation for the approaches, involving about 400,000 cubic yards of material. Excavated material at the east end went into the detour which had to be constructed prior to driving the tunnel. With completion of the excavation and detour, space became available for the contractor to install necessary facilities and begin work on the West Portal service road, bridges and the tunnel proper.

Tunneling Operations

The first phase of the tunneling operation consisted of placing three small holes, called drifts, in the mountain. One of these drifts was at the crown, and the others—one at each side—were at the lower limit of the steel tunnel supports, about 14 feet above roadway grade.

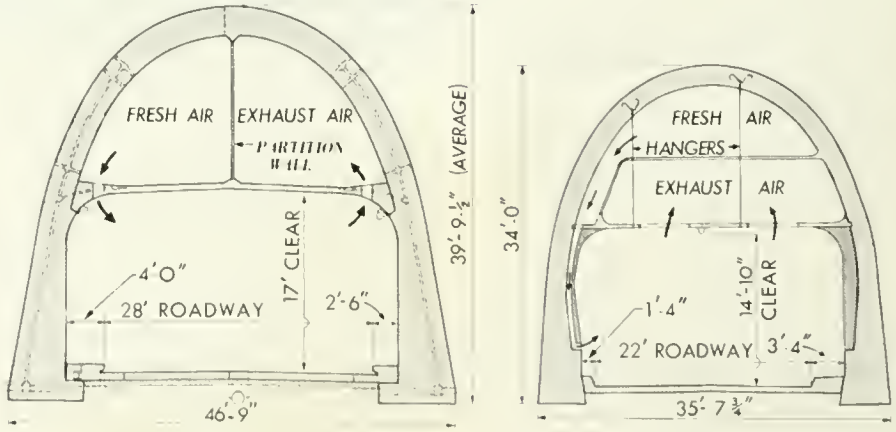
At a distance of 117 feet into the hill, a safe sandstone material was encountered. The workers then went from drift to drift, installing the steel ribs from wallplates to crown. Each rib was made up from six sections. Excavation then proceeded carefully from inside rib back out toward the portal. Only enough material was excavated to give the men sufficient working room. Excavated materials were taken out with a small air-operated loader through the side drifts. With this method, the workmen always had steel overhead to protect them. The core area was then removed from the outside with larger equipment.

Breostboard Jumbo

While assemblying and activating a breastboard jumbo (acquired by the contractor from the Morrison-Knudsen Co. who had used it in construction of the Broadway Tunnels in San Francisco in the early 1950's) the wallplate drifts were continued on into the hill.

This jumbo held breastboards tightly against the working face at all times, except in a small area where the excavation was being done. There were 16 forward jacks of 15-ton capacity each, placed in three rows, plus 2 jacks at the top. The jacks were hydraulically operated and they were enclosed in steel shells to prevent damage from mining or blasting. When the jumbo was forwarded, these jacks telescoped so that the breastboards never were held less than snugly against the face even with movement to the location ahead.

Four 45-ton rams held the jumbo steady and were used to move it forward. These were angled out from the sides (two to a side) and thrust against walers which were clamped to the steel ribs of the tunnel. When the jumbo was moved forward, the 45-ton pressure of these rams overcame the pressure of the breastboard jacks, forcing them to telescope without taking pressure off the face. As a



This drawing shows the contrast between the design of the first two tunnels (on right) and the newly completed tunnel. Major differences are a wider roadway, higher clearance, and a revision of the exhaust system.

Scaffolding rises for construction of the new portal building above the rounded hump of the tunnel top.

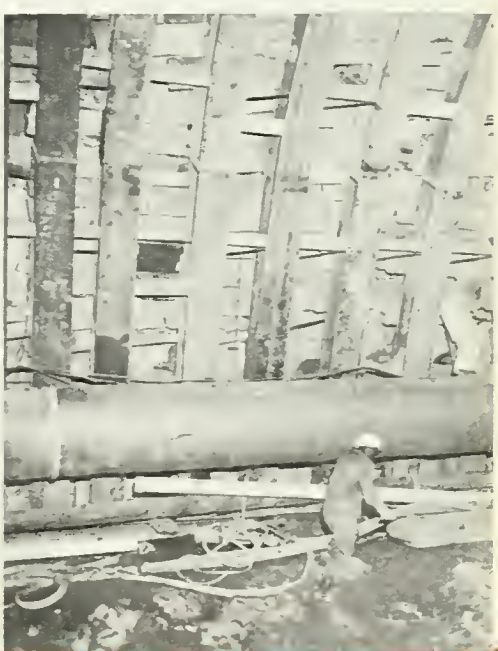
(Above) Working under the protection of the jumbo, construction personnel find that the shovel is still in style for excavation operations.

(Below) On the top level of the jumbo, miners demonstrate some of the obstacles of their work. Space is tight and some tasks are awkward to perform.

(Above) The new tunnel is finally excavated to roadway level at the east portal.

(Below) Concrete pouring by an air-propelled placement system uses compressed air to force the concrete into "slicklines" for desired delivery points.

(Below) Steel sets and timber lagging support excavation of upper portion of tunnel. Roadway level is about 14 feet lower.



A view of the completed concrete arch section, with forms in place for the ceiling above roadway.

Tiling operations mark the beginning of a more finished appearance for the tunnel.

safety measure, mechanical jacks were used in addition to the hydraulic rams.

Ribs

Miners are a tough, hardy lot and their working conditions usually leave something to be desired. The work is noisy, dirty, frequently wet and muddy, always hazardous, and is usually done in cramped quarters from precarious perches.

The material which was mined by spading (or blasting if required) fell to the tunnel floor under the jumbo and was picked up by a front-end overshot loader (called a mucker), dumped into a Dumpster and hauled to a canyon west of the job for fill as a part of the freeway.

The large steel ribs (tunnel supports) were erected in four sections: One lower section on each side was handled from below, and two crown sections were set up from atop the jumbo. Blocking was done and lagging was installed behind the steel supports to retain the unstable material.

Concrete Pour

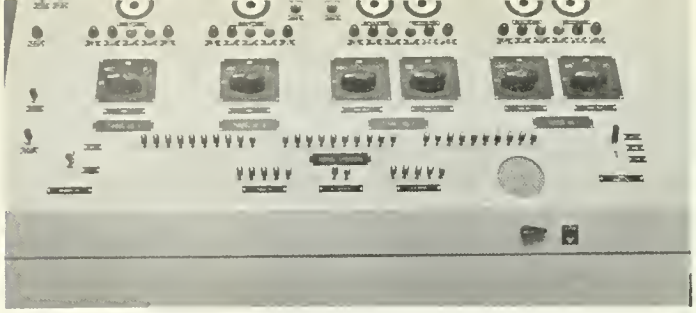
While mining of the full crown heading continued well into the mountain, other operations followed from the West Portal. The first of these consisted of underpinning (or supporting) the wallplates which carried the load of the mountain transmitted through the steel ribs. Underpinning was achieved by mining or

This photograph shows the partly completed partitioned ventilation channels above the roadway (see diagram at bottom of page 14).

A television camera, mounted at portal top, manitors traffic heading far the tunnel. The resulting "cammentary" is watched from the cantrol roam ta alert the staff af emergencies and/ar the need for lane cantral.

drilling holes at intervals to the ultimate foundation level, forming pilasters, and placing concrete up to the wallplates. After the pilasters had taken over their supporting role, the remainder of the excavation was com-

This huge ventilating fan, ane af two, supplies fresh air to the new tunnel.



The master cantral panel enables persannel ta handle a variety af situatians in the present three tunnels, with space available to hook up ta a future fourth tunnel.

pleted to roadway level, and footings were poured. Then, wall reinforcing was placed, track was laid to accommodate the wall forms with traveling jumbo, and the forms moved into place to receive the concrete pour.

Concrete pouring for the tunnel lining was done by using an air-propelled placement system. Concrete was chuted from truck mixers onto conveyor belts which transferred it to hoppers. The hoppers fed the pres-

These massive exhaust ducts take the "used" air fram the tunnel and arrange far its dispositian straight up into the atmasphere.

Small cross-tunnels enable personnel to get from one tunnel to another in a safe manner.

sure vessels located immediately beneath them. After the gates were closed, compressed air, introduced into the vessel, forced the concrete through pipes, called "slicklines," to the desired points of delivery.

Tiling

Completion of the basic tunnel lining was followed by tiling the ceiling, tiling the walls, constructing curbs and pavement, and installing operating and safety equipment.

The final result is a smooth-riding concrete pavement of safe, comfortably wide lanes; flanked by safety curbs and pleasing "seafoam" green tile walls and ceiling—all well lighted.

Other Details

After the third tunnel was completed and opened to traffic, the first two tunnels were closed, one at a time, and renovated. Troublesome sections of pavement were removed and replaced, the roadway area surfaces cleaned and painted, drainage facilities repaired, ventilating equipment overhauled, emergency facilities added, lighting modernized, and controls revised so that all three of the tunnels are operated from the new portal building.

The two older tunnels have fresh air and exhaust blowers in the portal buildings at each end. The third bore is ventilated from one end only. The portal buildings are equivalent to a six story building and house all of the ventilating equipment, controls, shop space and operating personnel. Provisions have also been made for the equipment of a future fourth tunnel (which will be built northerly of the present three tunnels) to be controlled from the one portal building.

CALDECOTT TUNNEL PROJECTS

Job	Date completed	Contractor	Contract amount
Tunnel No. 3	July 9, 1964	Connolly-Grafe-Brayer-Harney	$11,030,000
Strutting and drainage No. 1 and No. 2	March 31, 1965	Dan Caputo	298,100
Renovation No. 1 and No. 2	March 28, 1965	Steiny & Mitchel	832,800
Lane control	To be completed November 1, 1965	Steiny & Mitchel	338,000

Since each of the three tunnels have only two traffic lanes, it is not considered safe or desirable to have two directions of traffic in any one tunnel. Although there is always a considerable amount of traffic passing through the tunnels, it is predominantly heavy in the westerly direction in the morning and easterly in the afternoon. The first and third tunnels carry traffic in one direction only at all times. Traffic lane-changing devices are being installed so that the center tunnel can be used to carry traffic in whichever direction it will do the most good.

Adits

Small cross-tunnels, called adits, connect the main tunnels at three locations between the portals. These were intended to be used for additional safety during construction and are useful for tunnel maintenance and emergency operations.

The third tunnel as it looked in the later stages of construction.

New Routes Adopted

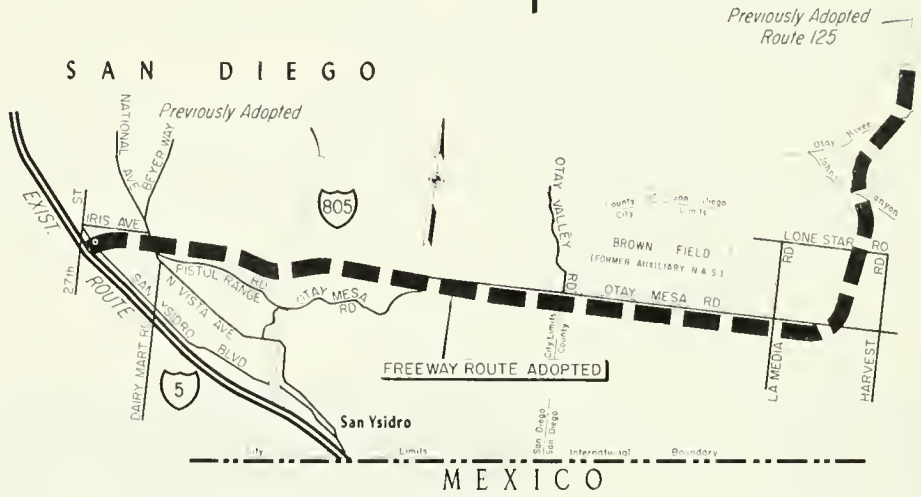
At its May and June meetings, the California Highway Commission adopted the location for 21.8 miles of freeways on five routes.

The commission also revised the routing of 1.8 miles of Route 59, a conventional highway southwest of Snelling in Merced County, to eliminate curves, and designated short sections of N Street and Broadway in Needles as a traversable route to carry State Highway 40 traffic pending construction of the Route 40 Freeway.

In San Diego County, the commission adopted freeway routings for 9.7 miles of interconnected Route 75 and 125 near the Mexican border. The new alignment will take Route 75 easterly for 7.1 miles from Interstate 5 near 27th Street, just south of Iris Avenue in San Diego, to about a half-mile east of Brown Field.

From this point, the newly adopted alignment for Route 125 runs 2.6 miles northward, with a slight jog to the west between Johnson Canyon and the Otay River. It connects on the north with a previously adopted location for this route northward to Route 54 near Sweetwater Reservoir.

The Route 75 and 125 freeways will form the southern and eastern legs of a belt-line system of freeways around the San Diego Metropolitan area.

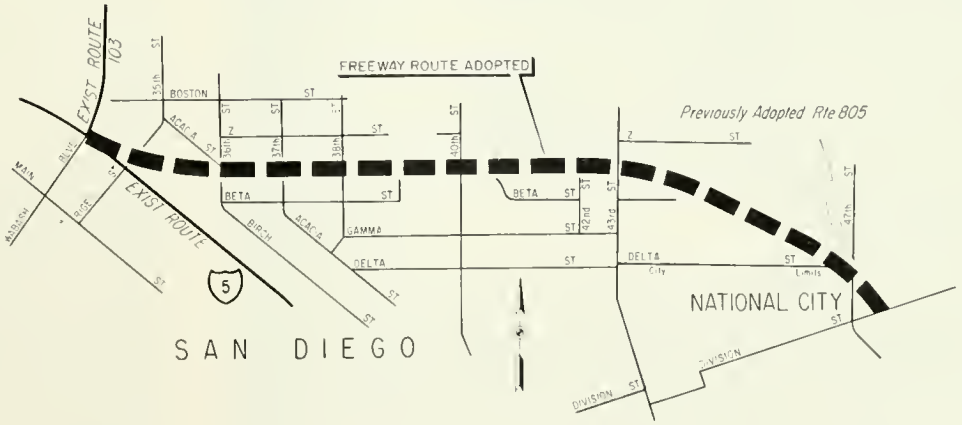


The commission also adopted a freeway alignment for Route 252 in its entirety in San Diego and National City.

This 1.8-mile connecting link between the Interstate 5 and Interstate 805 freeways proceeds easterly from the former at Wabash Boulevard (Route 103), approximately one block north of Beta Street, to 43rd Street in San Diego. It then turns southeasterly to the adopted route for the future Interstate 805 Freeway at Division Street in National City.

In Monterey County, the commission adopted a freeway location for 1.1 miles of Route 198 near San Lucas to provide a connection with the future US 101 Freeway. The new routing leaves the existing highway northeast of Cemetery Road, proceeds southwesterly to southwest of existing US 101, then turns more westerly to future US 101.

Farther north, the commission adopted a freeway routing for 9.2 miles of US 395 in Lassen County between Madeline and 0.8 mile south of the Modoc county line.

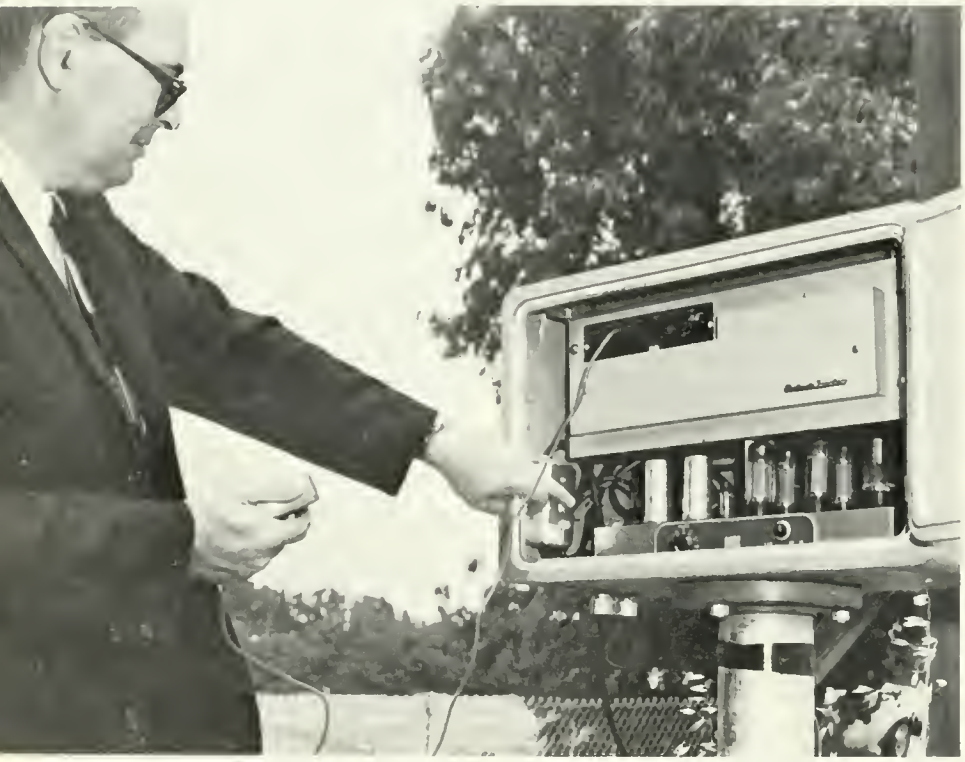


Talking Freeways

Radio Messages May Supplement Signs

The era of freeways that talk to drivers may be almost at hand if the promise indicated in recent tests of induction radio and other forms of audio highway communications systems by the California Division of Highways comes true.

Certain ethereal qualities seemed involved in the tests, for participating drivers suddenly began to hear a voice emanating from no logical source that advised them of traffic hazards they would encounter within the next few miles.



David J. Theobald, project engineer for fog studies, holds a microphone in his hand, preparatory to "planting" a message to be broadcast to motorists with vehicles equipped to receive test warnings.

But the source of the information was quite prosaic. Test automobiles were equipped with an antenna-amplifier-speaker combination, and this small electronic packet was picking up radiations from a nearby tape recorder that was feeding a message into a copper wire looped around a 700-foot section of freeway. As long as the test vehicle remained within the confines of the wire-loop the voice continued to repeat its message, and faded away only when the car had traveled the 700-foot limit of the system's sphere of influence.

The theory of augmenting with sound the visual traffic signs most drivers rely on for information is neither new nor original with the California Division of Highways. Signs have been the prime means of imparting on-the-spot information to passing travelers since at least the time of the Romans. Then as now, a person lost or confused can always stop and ask a local resident for directions. But in the last 20 years, increased speeds, restricted-access highways and massive traffic volumes have combined to alter the driver's environment drastically and to place ever-increasing demands on signs to keep travelers aware of where they are and what hazards might lie ahead.

Technology and the increased tempo in daily living have combined to make it more difficult for a sign to perform its function. The sign must compete for attention with every other item of interest to the driver, including traffic itself. And too often, when the sign is observed, its message doesn't negotiate its way to the observer's brain. The car radio is on, bases are loaded and Willie Mays is at the plate. Or the driver is deep in concentration trying to compose his next sales approach or the cutting remarks he should have made earlier in the day when his boss chided him for spending too much time at the water cooler. The distractions that compete with traffic signs are almost endless.

The tests were triggered by Senate Resolution 33, 1963 California legislative session. The intent of the resolution was that ways should be found and put into practice for warning drivers of the need to observe caution when driving during periods of reduced visibility. A second objective was to warn drivers, whose visual range is shortened because of fog or other abnormal circumstances, that an accident has occurred on the highway ahead of them and blocked their path.

Either situation is most difficult to overcome with a sign, for not only would it have to differ radically in concept from those in general use today; it would also have to be one that could be energized on short notice to meet a temporary given situation and then fade out once normality prevailed.

These were the obstacles that led to the exploitation of the long-known principles of electromagnetic induction with the ultimate aim of making highways talk to people.

The site of the tests was a stretch of Route 160 north of Sacramento. The 700-foot length of the test area was arbitrarily selected because that

happened to be the distance between a culvert and an overcrossing that made ideal boundaries. A nearby utility pole made a convenient location for the ground equipment and the lines it carried were tapped to supply electric power needed to energize the system.

The roadside transmitting equipment consisted of a tape recorder feeding a prerecorded message into an audio amplifier. The amplified output was then fed into the loop of wire that had been buried along the roadway, and a magnetic field, varying in accordance with the message, was set up in the vicinity of the loop.

The companion equipment installed in test vehicles consisted of a small magnetic pickup coil in which a varying current was caused to flow by the magnetic field from the roadside loop. This signal was fed into a transistorized amplifier and then to a loudspeaker that relayed the recorded message to the driver and other occupants of the car.

During the tests the same prerecorded message was repeated continuously, but it could have been changed within seconds at the roadside by simply erasing the tape and dictating a new message into the recorder. The potential of a refined system is almost without limits.

By installing the wires when new freeways are built connecting the two sides at one-mile intervals and installing a transmitting device, a transstate freeway theoretically could be wired for sound along its entire length. If the transmitters were connected to telephone lines, messages could be changed from a message center and individual machines turned off and on at will.

Cost could be staggering, but, if the public believes the benefit worth the price, such an elaborate system could become a reality.

In an emergency situation, where such a network existed, a California highway patrolman on the scene could combine his two-way radio and the telephone connection to dictate a message into specific loops that in turn could warn drivers of impending danger.

The reception of messages transmitted through the system can be controlled to very precise areas by specific placement of the wire loop. Adjustments of the loop and the amplifier output can cause the message to be heard on only one side of a divided highway or even a single off-ramp. This directional aspect is of considerable significance and enhances the value of the system in many situations. If it is imperative to advise traffic flowing in one direction, those same facts could be erroneous and misleading if imparted to vehicles traveling in the other direction.

The entire operation of an audio communications system is, of course, predicated on the assumption that all vehicles using state highways possess the receiving equipment. The time when the assumption becomes reality should not be too far off, for the automobile and electronics industries are both aware of the potential need for such devices. In mass production, the cost of the receiving set would be nominal.

And there are other details that must be tested before such a system is integrated into California highways. A minor one that could be overcome at the time of installation of equipment in autos is the fact that the system won't work if drivers shut off their receivers—so they would have to be installed to work off the ignition switch and be in the "on" position at all times when the ignition was unlocked.

A far more important detail is the human factor. Just how are people going to react when they suddenly hear an unexpected voice the first few times information is relayed to them? No one knows at this time but the answer should be forthcoming, for the University of California's Institute of Transportation and Traffic Engineering is conducting tests to uncover what a driver will do when the highway suddenly begins to speak to him in a voice both loud and clear.

This section of Route 160 north of Sacramento was the site for experimental tests on the "talking freeway." Hidden by trees, the control box activates the induction loop, providing a reception zone within the dotted lines.

Drainage Solution

Master Agreement Covers Sacramento Freeway Net

By P. D. HAUG, District Hydraulics Engineer

When design of the north-south freeway, a portion of Interstate 80 in Sacramento located between 29th and 30th Streets and extending from A Street on the north to R Street on the south, was started in early 1962, the usual problem was encountered—what to do with surface runoff.

A preliminary study was made to determine if freeway construction would add more impervious area, to the detriment of the existing city drainage system. All proposed freeways within the city were considered: from Broadway north to the American River and from the Sacramento River east to 65th Street.

The study disclosed that the *total* impervious area would not be appreciably different after freeway construction than before. In other words, the total acreage of freeway pavement, shoulders and ramps to be drained would be just about offset by the total of the roof, patio, driveway and sidewalk areas removed. The nature of the local drainage system was such, however, that the *pattern* of runoff would be affected by freeway construction.

City Accepts Runoff

To begin with, since no noticeable increase in impervious acreage would occur with freeway construction, the city was asked to accept all freeway runoff into its storm system. Close coordination was also requested of the city in activities pertaining to drainage design.

The city responded with a number of considerations. One was that amortization costs of Sacramento's combined sanitary and storm drainage trunk lines are met by direct service charges against sewer users, in addition to maintenance of the system, and that the state would not be paying these service charges.

During heavy rainfall, city sewers are full to capacity and water stands in a number of streets. The city was also concerned, therefore, with the state's pumping plants which would force water from depressed freeway sections into the system and would preempt the trunk lines which were already having difficulty handling local street drainage.

Concern was also expressed over the head which would be developed from the elevated portions of freeways by drainage appurtenances which would also take inflow precedence over local street drainage.

Knowing that the state's general policy is to participate in providing a joint project to the extent of benefits derived, the city asked for consideration of a cooperative project to provide adequate drainage where it does not now exist and where concentrated freeway drainage would tend to aggravate local street flooding.

The next step was for District 3 to embark on a thorough drainage system study to determine hydraulic requirements. It soon became apparent that in place of the ordinary procedure of drafting an individual agreement for each freeway project as it progressed through the design stage, this situation could best be met by drafting one master agreement covering all proposed projects.

Although some units, primarily on US 50 from 34th Street to 65th Street, are not scheduled for construction for several years, planning was far enough advanced to determine drainage requirements.

Following is a route-by-route description of the drainage master plan (*see map*).

U.S. 50, 34th to 65th Street

Although this section of freeway will be the last to be built, its drainage requirements had to be solved first. This was because what is done here ultimately will have an effect on the system relieving the north-south freeway (Interstate 80). A depressed portion is planned on this section between 42nd Street and 62nd Street, with provision for separation of drainage at 51st Street into two different pumping systems.

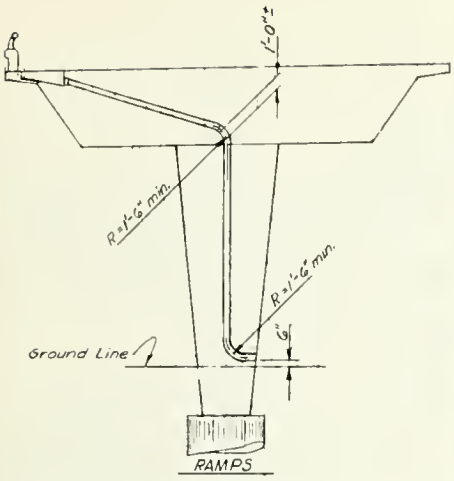
The depressed portion from 51st Street to 62nd Street will discharge east to a city trunk on 65th Street, where it is then carried north via city line to city sump No. 31. The city also agreed to accept all water from the future 65th Street Interchange into its 65th Street trunk. The state will then provide funds necessary to increase the pumping capacity of sump No. 31 to facilitate the additional concentrated inflow.

A gravity line will drain the 42nd Street to 51st Street portion from the pumping plant at 45th Street west to the city trunk on Alhambra Boulevard. This line will also drain the section from 42nd Street back to Alhambra Boulevard. The city agreed to maintain this outfall.

Interstate 80, 29th–30th Street

The only available outfalls on this north-south section adequate to carry the concentrated flows of water from this freeway unit are city lines on E, H and O Streets.

A freeway pumping plant located at C Street, draining the short depressed portion between C and A Streets, is discharged into an existing line on 30th Street.



Schematic diogram of viaduct deck drainage, showing use of curved pipe inside deck slab and column.

Photo shows portion of viaduct with grating in place for deck drain.

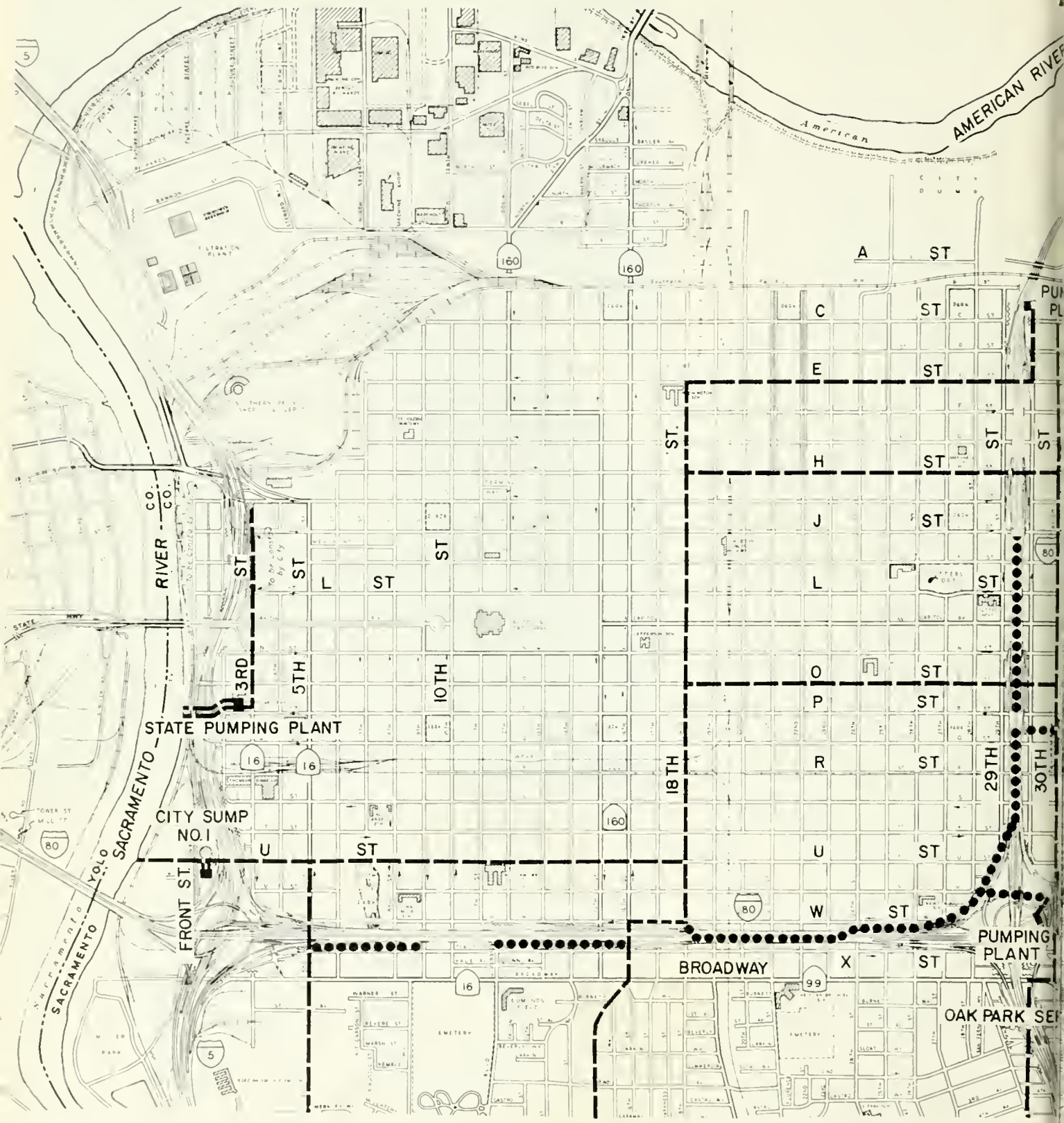
South of C Street, other freeway waters are collected at the toe of the fill slope and carried in gutters or a collector system to the other drains on H Street and O Street. Drainage from the Fort Sutter Viaduct (J Street to P Street) is collected on the structure and carried down the median columns, discharging into a ground level valley gutter. A drop inlet system intercepts this water in the median below, and conveys it by a collector which discharges into a city trunk on O Street. (This method overcomes the problem of pressure discharge from an elevated freeway directly into the trunk lines).

The previously mentioned state outfall from the 45th Street depression on US 50 drains into the city trunk on Alhambra Boulevard and would overload this system. Through negotiations with the city, this was acceptable if the state would then relieve the Alhambra trunk in the vicinity of P or Q Street with a line of equivalent capacity to the flow which would discharge into the Alhambra line from US 50.

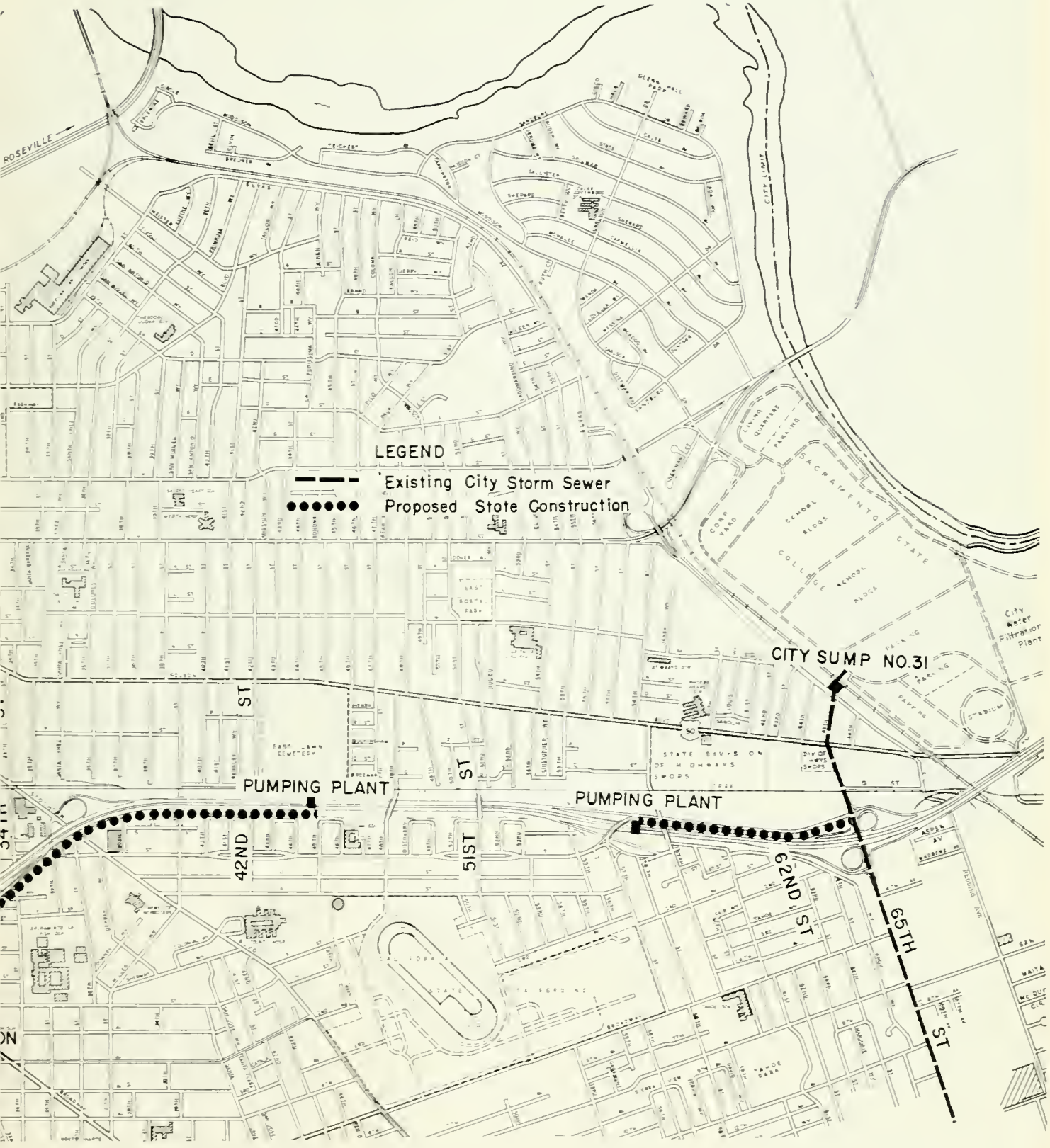
With this in mind, the district proceeded to design an overflow from the Alhambra Boulevard trunk which would flow west between P and Q Streets, then turn down the median and proceed south toward the Oak Park Interchange (I-80/US 50) and pumping plant which serves the depression on the US 50 leg. Freeway waters would be collected en route.

At the Oak Park Interchange, the line proceeded west along the W–X Street freeway (also Interstate 80) and discharged into the city's 108-inch trunk on 18th Street. At 18th Street the city agreed to the acceptance of the Alhambra Boulevard relief and freeway water, and also to maintain this line as a part of its system.

Manhole cleanouts on this line were placed in city streets so maintenance by the city could be performed off the State right-of-way. At several locations along the W–X Street freeway, the district permitted city street drainage to be discharged into the state outfall from lines that were to be severed or relocated by freeway construction. Cost estimates indicated it was economically feasible to enlarge the state outfall and admit city street drainage rather than provide a separate relocated line at State expense.



The layout of the master drainage plan in relation to existing and proposed freeways in the Sacramento City area is shown in the above map. The areas concerned include US 50 from 34th to 65th Streets, Interstate 80 between 29th and 30th Streets and between W and X Streets. The depressed section on Interstate 5 between U and L Streets was not included in the agreement since this north-south section will be drained independently by a state pumping



plant with discharge directly into the Sacramento River near P Street. Studies showed that such a comprehensive drainage plan was the most beneficial and economical use of both state and city funds to solve this complex problem. This master freeway drainage agreement will result in considerable savings to both city and state.

Aerial view showing key routes in Sacramento freeway network and area served by drainage system.

Interstate 80, W–X Street

Natural high ground at 10th Street on this east-west portion of I-80 provides the drainage split. Freeway water from 10th Street east will be intercepted and carried in a parallel drain within state right-of-way to the city's 108-inch trunk on 16th Street. Drainage from 10th Street west was likewise carried in a parallel drain to the 60-inch city trunk on Fifth Street. The city's sump No. 1 at U and Front Streets will handle the water from the I-80/I-5 interchange.

Interstate 5, 2nd–3rd Street

The depressed section on I-5 between U and L Streets was not included in the agreement since this north-south section will be drained independently by a state pumping plant with discharge directly into the Sacramento River near P Street. The remaining portion, from L Street to the viaduct over the Southern Pacific yard, will drain into a city trunk on Third Street.

Studies showed that this comprehensive drainage plan was the most beneficial and economical use of both state and city funds to solve this complex drainage problem.

The district's negotiations with then City Engineer E. A. Fairbairn and Assistant City Engineer Carl Jennings (now city manager and city engineer respectively), and with Ron Parker of the city engineer's staff were carried on in an atmosphere of mutual cooperation. All concerned were aware that the use of a master freeway drainage agreement in this instance meant considerable savings to both state and city.

Humboldt Bay Bridge Feasible, Report Says

A toll bridge across Humboldt Bay is feasible from an engineering standpoint but cannot be financed exclusively from toll revenues.

This is the conclusion of a feasibility report prepared by the State Division of Bay Toll Crossings for the California Highway Commission. The report was presented to residents and civic leaders of the Eureka area on June 9, 1965.

The report estimates that the proposed bridge would cost $4,011,000 to build and that toll revenues would fall $1,455,000 short of financing the construction bonds.

For the project to be undertaken, other sources of revenue would be required to make up the deficit, according to the report.

The study was financed by a $40,000 appropriation from the Highway Commission on June 24, 1964.

The study was made on the basis of the following assumptions:

—The bridge would extend from R and Fifth Streets in Eureka to a point on the New Navy Base Road north of the Georgia-Pacific Corporation Mill on the Samoa Peninsula.

—This route would bypass the main shipping channel of Humboldt Bay, eliminating the immediate need for a high-level bridge or a movable central span. An earlier study indicated that a movable span would add some $2 million to construction costs.

—The toll would be 35 cents for automobiles, graduated upward for trucks and buses.

—The two-lane facility would have 30 feet of clearance over Samoa and Eureka Channels and 15 feet over Middle Channel. The remainder of the 1.85-mile structure would be trestle or fill.

The report notes that the bridge would save up to 15 minutes and 12.2 miles of driving from motor trips around Humboldt and Arcata Bays from Eureka to the Samoa Peninsula, the site of several lumber mills.

Traffic projections and estimates show that 1,600 vehicles per day would have used the bridge if it were in operation during 1964 and that 2,300 vehicles per day could be expected to use it by 1969.

BRIDGE CONSTRUCTION HEAD LEAVES; HINEMAN NAMED

I. O. Jahlstrom, bridge engineer—Operations for the State Division of Highways, retired on July 31 after 37 years of state service.

Howard R. Hineman has been appointed to succeed Jahlstrom. Hineman was construction engineer for the Bridge Department's southern area office in Los Angeles.

I. O. JAHLSTROM

Jahlstrom came to work for the division in 1928 as assistant resident engineer on a bridge construction project on the Coast Highway near Orick, north of Eureka. For the next five years he was resident engineer on numerous steel, concrete girder and arch jobs including the much-photographed concrete arch structures at Rocky Creek and Bixby Creek on the Coast Highway south of Carmel.

HOWARD R. HINEMAN

Between 1933 and 1937 he was resident engineer on the West Bay Crossing suspension structure of the San Francisco-Oakland Bay Bridge, after which he returned to the Bridge Department in Sacramento as construction engineer.

He was appointed principal bridge engineer—Operations in 1947, a position which has not only involved overall direction of the construction of approximately a billion dollars' worth of bridges but the inspection and maintenance of all structures on the state highway system as well.

Jahlstrom was born in Astoria, Oregon, and attended grade and high school in Hockinson and Battle Ground, both in the State of Washington.

Jahlstrom served in the U.S. Navy during World War I. He graduated from Washington State College with a B.S. degree in engineering in 1923 and was awarded an M.S. degree by the University of Illinois in 1925.

He is a member of the American Society of Civil Engineers, the American Concrete Institute, the engineering honor fraternity Tau Beta Pi and the University Club of Sacramento. He is a Mason and a member of the Shrine.

Jahlstrom, whose home is at 2783 Harkness Street, Sacramento, has a daughter, Ruth Marie Wagner, and a son, Jack I. Jahlstrom, both of Sacramento.

Hineman, who was advanced to succeed Jahlstrom, joined the division as a junior engineering field aid in 1932 on construction of the Kings River Canyon Highway and transferred to the Bridge Department as a junior bridge engineer in 1935, serving on bridge construction projects in southern California for the next six years.

Hineman was a lieutenant commander in the Navy during World War II. His duties included command of a company in the 64th Naval Construction Battalion.

From 1949 to 1962 he was in charge of preliminary investigations and planning in the Los Angeles office of the Bridge Department. Since 1962 he has been in charge of all bridge construction on the state highway system in southern California.

Hineman was born in Salina, Kansas, and attended grade and high school in Anaheim, California. He graduated from the University of California at Berkeley with a B.S. degree in engineering in 1931. His home has been in Fullerton (830 West Valley View Drive).

He is a member of the American Society of Civil Engineers.

Hineman is married and has two daughters.

Looking southwesterly across the completed freeway toward the town of Buellton. The Zaca Creek Channel Change is in the middle foreground.

Buellton Bypass Project

By J. B. POPNOE, Resident Engineer

On June 10, 1965, the Buellton Bypass, extending from 0.7 mile south of Santa Ynez River to 0.7 mile north of Buellton, was opened in its entirety to traffic. The completion of this 3.6-mile project eliminated the last section of two-lane undivided highway on US 101 south of the Monterey county line in District 5.

The unincorporated community of Buellton (population 1,500) lies at the junction of US 101 and Route 246. The latter route carries traffic to the Lompoc-Vandenberg AFB area to the west and to the tourist centers of Solvang and Cachuma Lake to the east. This east-west highway thus carries a great amount of tourist traffic during the summer months. Buellton itself attracts a considerable number of touring visitors, because of a well-known restaurant located adjacent to the old highway.

US 101 in Buellton proper was a four-lane divided roadway running through the center of town. It was flanked on both sides by frontage roads and intersected at grade by Route 246 and several other cross streets. Due to the many conflicting turns, this intersection was the scene of a large number of accidents. There were 38 accidents recorded at this intersection in the years 1962 to 1964. Of this number, 31 accidents were violation of right-of-way accidents such as left turn into approaching

traffic or cross traffic being hit broadside by highway traffic. Therefore, the Route 246/US 101 Separation constructed as a part of the new freeway was one of the major benefits of an immediate nature for the motorist.

Buellton is also served by two other full interchanges. To the south is the Santa Rosa Road Overcrossing and to the north, the North Buellton Overcrossing. All three are diamond interchanges.

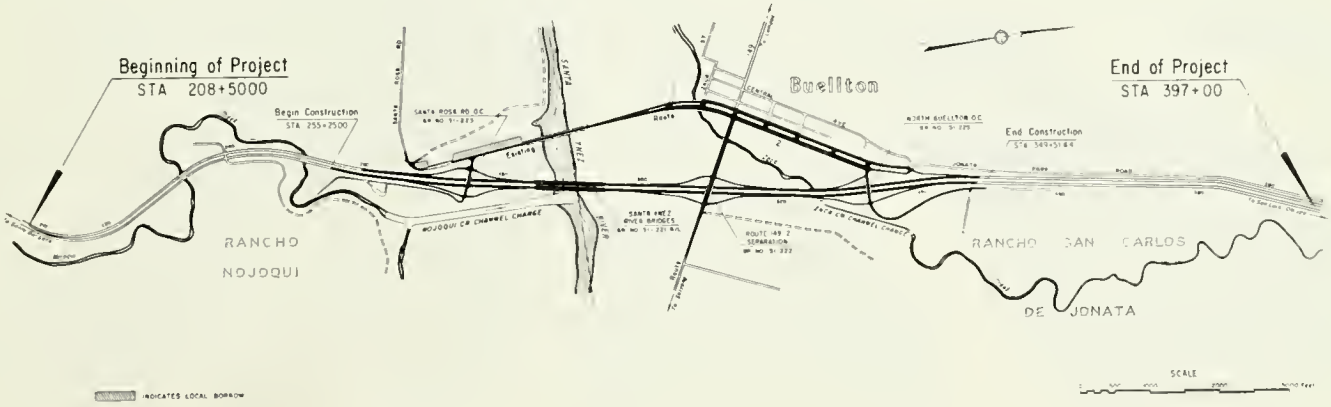
In addition to the structures listed above, the contract involved the construction of a four-lane divided highway with twin 1,000-foot box girder bridges spanning the Santa Ynez River. The two separate roadways sit on a common pier wall to allow for expansion at a later date to six lanes, which can be done easily by the addition of a 12-foot lane to each deck. Formerly, US 101 had been restricted to two lanes by the old Santa Ynez River Bridge. The transition from four- to two-lane traffic at the old structure had proved a dangerous bottleneck for the high-speed traffic. The completion of these two structures eliminated another hazardous condition on the old highway.

Actual construction began in January of 1964, shortly after the contract was awarded to Oberg Construction Corporation of Northridge.

The grading was essentially a borrow job requiring about 150,000 cubic yards. Of this sum, 55,000 cubic yards of local borrow were designated by the contract to be available from slope grading performed on the fill for the old Santa Ynez River Bridge. The remainder of the material was obtained by the contractor from imported borrow sites near the job. The material used was mainly a river-run gravel of good quality. The method of haul was push-loaded scrapers.

Aggregate bases for the project were produced by the contractor

Aerial view, taken during later stages of construction, looking north, shows old and new highways in relation to Buellton. Structures, beginning in foreground, are Santa Rosa Road Overcrossing, twin bridges over Santa Ynez River, 101/246 Separation, and North Buellton Overcrossing. Nojoqui Creek channel is at right.



from state-owned material. The state's Petan Pit is located one-half mile west of the project in the Santa Ynez River, and it provided a good source of material for contractor's crusher. Road-mixed cement treated base was also specified in the contract.

The contractor elected to slipform the portland cement concrete pavement on the project. This paving was done by Owl Slipform Company with a Guntert-Zimmerman paver.

One operation that was of interest was the contractor's method of constructing the large pier walls for Santa Ynez River Bridge. Using ganged forms up to 32′ x 62′, he was able to strip and reform a section in one day with only a minimum of labor. Since there were 10 pierwalls ranging in size up to 32′ x 110′, this method of construction greatly speeded the bridge operations.

Nojoqui Creek, which had previously joined the Santa Ynez River to

ABOVE: Looking southerly from the North Buellton Overcrossing of the Route 246/101 Separation. Buellton is off the picture to the right.

BELOW: Looking northerly from the Santa Rosa Road Overcrossing northbound on-ramp at the Santa Ynez River Bridge and the Route 246/101 Separation Buellton is in the left background.

the west of the project, was realigned to permit both the creek and the Santa Ynez River to flow under the new bridge. The new channel is 2,800 feet long with a minimum bottom width of 100 feet. Its side slopes are lined throughout with ½-ton rock and facing rock.

The portion of the old highway in Buellton received a complete facelifting also. The former frontage roads were widened to 42 feet, resurfaced, and restricted to one-way traffic. Between the frontage roads is a 76-foot mall. This is to be landscaped by the local businessmen's association in cooperation with the County of Santa Barbara. When completed, this should give the center of Buellton a decided parklike quality, which should be a pleasant improvement over the traffic congestion of former years.

Editor's note: Research for the Buellton Bypass article brought this dividend—a picture of the dedication of an earlier bridge over the Santa Ynez River, vintage 1917. Interestingly enough, the youngster (second from right) is Lyman Olsen, now Assistant Maintenance Engineer for the Division of Highways.

Scenic Committee Members Renamed

Governor Edmund G. Brown has reappointed Harry P. Schmidt of Gustine and Edwin S. Moore of San Francisco to new four-year terms on the state's Advisory Committee on a Master Plan for Scenic Highways.

Both were appointed to the original committee in 1963 after its creation by the 1963 Legislature.

Schmidt is a Merced County supervisor, and has served as chairman of the committee since its inception.

Moore is executive vice president of the California State Automobile Association.

Other members of the committee are: Robert Grunwald of Hanford, Richard M. Leonard of San Francisco, Dee W. McKenzie of Sacramento, Nathaniel M. Owings of Big Sur, and Charles Perry Walker of Manhattan Beach.

The State Department of Public Works has announced the award of a $5,945,745.70 contract in Stanislaus County for grading and paving 13.1 miles of four-lane Interstate Route 5 Freeway (Westside Freeway) between 0.9-mile south of Del Puerto Canyon Road and the San Joaquin County Line, approximately three miles west of Patterson.

NATIONAL HIGHWAY WEEK OPENS SEPTEMBER 19

The 1965 observance of National Highway Week has been scheduled for September 19–25.

A wide range of highway-oriented events and programs, including freeway dedications, ground-breakings, special exhibits and radio and television shows is on the agenda.

A statewide committee prompting the observance is headed by Sherman P. Duckel of San Francisco and Harrison R. Baker of Pasadena as coordinators for northern and southern California, respectively.

Governor Edmund G. Brown issued the following statement with regard to National Highway Week:

> For Californians, the annual observance of National Highway Week means an opportunity to gain fresh perspective on a major aspect of our state's forward progress. We are so accustomed to our position of national leadership in the development of safe, modern highways that we often take their benefits for granted.
>
> In the past six years we have more than doubled our mileage of full freeways, and now have more than 1,700 miles of these life-saving, time-saving facilities in operation. An additional 500 miles are under construction, and thousands more miles are on the drawing boards. We are carrying out in efficient, orderly fashion our long-range plan for freeways and expressways, including the California portion of the National Interstate System.
>
> With our motor vehicle registration approaching 11,000,000, we have a degree of personal mobility undreamed of a generation ago.
>
> Now we are broadening our outlook. We are devoting more attention to the relationship of highways to our environment, and are exploring new methods and systems of transportation. But for many years to come, the mainstay of our transportation service will be our road, street and highway network. National Highway Week is a good time to reemphasize our determination that there will be no slackening in California's effort to provide for our motorized population the safest, most efficient highway system in the world.
>
> EDMUND G. BROWN, *Governor*

Minor Improvements Program

By JAMES E. WILSON, Traffic Engineer

Mammoth highway undertakings, made necessary by America's growing automobile-oriented population, have accustomed us to think of highway improvement in terms of eight-lane freeways, complex interchanges, and projects which quite often have multi-million-dollar price tags.

In addition to equating highway improvement with large monetary expenditures, we are inclined to make a direct association between freeways and safety. (It is a fact that freeways are about twice as safe as other roads and streets.) There are other improvements to be made, however, and their price tags label them as the "bargains" of the overall highway improvement picture, especially in terms of safety.

Throughout the nation, much attention is focused upon the national system of interstate and defense highways program. With its target date for completion looming ahead only seven years from now, this emphasis is well deserved. Other projects, equally ambitious and worthwhile, are the work of the states, counties, and cities.

All of these superhighways will decrease the pressure on presently overworked roads and streets. The fact remains, though, that *none* of these large projects is going to do away with the conventional thoroughfare.

Term 'Minor' Is Relative

With this firmly in mind, the California Division of Highways has for many years channeled certain of its funds into a minor improvement program to increase the safety of the motorist who invariably uses conventional roads and streets for at least part of his travels by automobile.

(These projects are "minor" only in proportion to the funds expended; they are frequently "major" to the people most closely concerned.)

Many of these roads were built 50 years ago, before the advent of the

BEFORE: Cold Creek Bridge on Route 20 near Ukiah, California was the scene of 95 accidents (74 persons injured, four killed) in six years. The realignment of this section of the road is being designed, but the accident record necessitated immediate improvement.

AFTER: Accidents at this location were reduced from seven to two per year by replacing the concrete bridge railing on the offending side with a continuous metal beam strip and correcting the super-elevation (project cost: $4,006).

motor vehicle, and some of their features are anything but synonymous with safety at the speeds in use today. Certain of these roads are not equipped to handle the increased volume of traffic safely. The elimination of their many inadequacies cannot be achieved overnight, of course, but if a maximum number of areas can be afforded a little improvement from time to time, the results will be fruitful from a safety standpoint.

The funds for minor projects unfortunately do have to compete with the heavy financial demands of the superhighways. The judicious distribution of these funds then becomes an important issue. The division of this small pie has been worked out as fairly as possible by assigning the appropriate priority to troublesome spots.

This process can best be shown by outlining the procedure used in one of California's 11 districts. In the 13,000-square-mile area of one district, 8,428 reports of accidents on state highways were received from 9 California Highway Patrol area units and 27 police departments in 1964.

Reports Are Reviewed

The ensuing collection of reports was reviewed, and tabulations were made with the general approach that —as a starting point—when three or more conflicts occur in a calendar year, the location is to receive consideration as a potential "problem spot." This approach considers that two conflicts at one point can be coincidental, but beyond that, there may be some other factor that should be reviewed.

Also, whenever driver statements or the "opinions and conclusions" of the investigating patrol officer indicate any cause other than driver error or mechanical failure as the primary factor in the accident, a review of the site is made promptly, regardless of the number of previous incidents or the lack of them.

All accident reports are read, coded, and posted on accident profiles as a daily procedure. These profiles provide at-a-glance information of the points of recurrence in the district, and tell whether an area has been free of conflicts in previous years or whether there have been occasional problems over a long period of time.

The traffic engineers who evaluate potential minor improvement spots rely upon information recorded on accident profiles for part of their studies. Seen here are Don Foster, Assistant District Traffic Engineer (left), and Blair Geddes, District Traffic Engineer, both of District 3.

Reports are maintained (in current files with a folder for each year) for a period of five years. Each profile sheet is placed in location order for reference by the district. As a visual reminder, a map is on display and markers are used to indicate each problem point as it develops. This allows for the review of all problem spots in the district simultaneously. As spot locations are improved, the flags at those points are removed.

Once a flag goes up, a detailed study is begun. All past accidents are reviewed back to the time when any major change was made in the roadway—or if none have been made in the last few years—then back to the five year starting point of the accident files. The reports are studied, and a collision diagram and/or summary prepared as indicated. Even if a definite pattern is obvious, a field study is generally carried out.

Onsite Inspection

If no pattern emerges, onsite inspection may be especially helpful in providing insight as to a possible approach and tentative solution. In the field review, it may be useful to answer certain questoins: Has native shrubbery or tree growth created a restriction of vision? Has traffic volume increased to multiply the changes of a conflict? Has general speed increased so that approach speed is too high for conditions? Has some other factor influenced the situation or created a distraction? Is the condition obvious to the approaching traffic or is driver aid needed? Is there a daytime or nighttime aspect to the problem?

Clarification of the problem itself is a major influence in the district's recommendations for improvement. How can the spot be made safer? Should the district clear roadside growth? Add signs? Delineate? Reconstruct? Or should the improvement be a combination of several possibilities?

Accident sites are pinpointed on district maps to provide instant information concerning the troublesome spots within that area.

Although improvements are individually adapted to a particular site, they generally fall into the 10 categories which follow:

1. Delineation
2. Protective guardrail
3. Intersection channelization
4. Reconstruction
5. Safety lighting
6. Flashing signals
7. New signals
8. Modified signals
9. New signals with channelization
10. Modified signals with channelization

Some minor improvement projects, are undertaken for "operational betterment." By altering signals to coincide with the current traffic flow, and by assigning the right-of-way, the capacity of the intersection is increased and the stream of traffic is more orderly. Any resulting increase in safety is largely incidental, but important because a driver is less inclined to take chances when he knows that his turn to proceed is forthcoming. He is less inclined to become short of patience and to make a "chance" maneuver that is imprudent. If his emotions rule the situation instead of his good driving sense, that driver invariably becomes a poorer driving risk, and the site where this occurs with frequency may achieve a reputation as a problem spot.

More Than One Solution

The problem spot, once its identity is established, may actually lend itself to more than one solution. Because of the financing available for spot improvements, however, the district is likely to choose the least costly measure that can be expected to cope favorably with the problem, thereby spreading the funds to cover as many troublesome locations as possible. The saving grace of using an economical approach is that if a certain improvement falls short of the desired results, further improvements can always be made at a later date.

There are three specific sources of funds for minor improvements within the means of the California Division of Highways. Projects exceeding $50,000 in cost are placed with other major construction projects in the annual fiscal-year planning budget submitted to the California Highway Commission for approval. Naturally, funds from this category are reserved for prime locations where a simple and less costly solution would do little to eliminate accident hazards. Intermediately priced projects, costing from $5,000 to $50,000 are financed from any available contingency funds. This also requires a commission vote. Projects under $5,000 are financed through a fund set up for minor improvements, the formalities of which are simpler. Other financial aid for spot improvements may come from the city or county involved, or from the federal government.

Beginning July 1, 1965, projects costing $5,000–$50,000 will be financed from a special Traffic Safety Fund. This will provide a total of $3,000,000 per year.

Federal authorities in fact, encouraged recently by statements from President Lyndon B. Johnson, have advocated an accelerated program for accident reduction, and California's spot improvement campaign is but one program which has been accelerated to comply with these national ambitions.

92 Locations Studied

Aware of the various methods available for project financing, the district studied 92 separate locations in 1964. In most cases, both accident diagrams and accident summaries were prepared. Then, after a field review of each site was completed, 35 projects were chosen to receive immediate action. The cost of improvements at these spots ranged from $251 for purchasing and installing 50 feet of guard rail to $195,000 for modernizing and coordinating the signal system at all intersections of a state highway which passes through a town of 15,000 population.

One project, illustrative of the middle range, was completed at a cost of approximately $25,300 (of which the

ity involved contributed approxiately $15,500 of the total). It was ndertaken at an intersection where series of accidents had occurred in he two-year period preceding the imrovement. An accident review and ummary substantiated the conclusion hat the majority of reported accients involved vehicles attempting to ake left turns. Traffic at the intersection was controlled by a two-phase, ull traffic-actuated signal with mast rms having eight-inch indications. Illumination was provided by mast arm ounted luminaires on each corner of he intersection. Stop signs were in lace on each leg of the intersection.

The south leg of Peck Road and he east leg of Valley Boulevard were ivided with an eight-foot concrete urbed median. Painted crosswalks ere in place across both legs of Valey Boulevard. A separate right turn ne existed on the south leg of Peck oad as shown in the before photoraph. Both streets were zoned for 5-mile-per-hour speed.

Left Turns Cause Congestion

The field investigation emphasized that congestion and delay resulted from left turn movements on all legs of the intersection. The lack of left turn channelization limited through traffic to the curb lane, which resulted in prolonged clearance time for through traffic and caused the left turns to be made primarily during the amber signal periods. The delay to left-turn vehicles also affected cross-street traffic, since such traffic had to wait until the intersection was clear of the left-turning vehicles from the cross street.

The advised improvement consisted of the modification of the existing controller to provide for four auxiliary movement controllers, median signals on Peck Road with 12-inch green arrow sections, walk-wait signals on each leg of the intersection, replacement of the old signal heads with 12-inch sections, and left-turn channelization on each of the four legs.

An "after" study was made to evaluate the effectiveness of the alterations. The total number of accidents declined 39 percent (from 64 to 39). Intersecting accidents were reduced 89 percent (from 9 to 1), and approaching accidents declined 94 percent (from 37 to 2). Accidents involving injury declined 35 percent, and the number of persons injured declined 44 percent. Overtaking accidents, however, increased 71 percent (from 17 to 29).

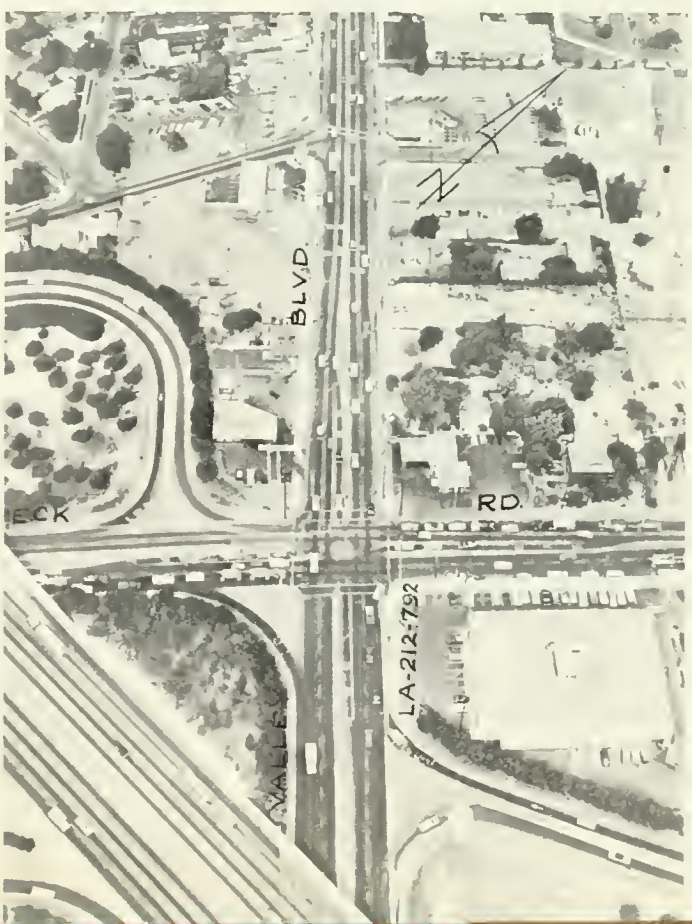
A significant reduction in the total number of traffic accidents took place in spite of the increase in accidents involving overtaking vehicles. The left-turn approaching type of collision was almost completely eliminated.

Traffic Volume Increases

Another factor to consider in contrasting the "before" period with the "after" period is that an increase of 19 percent in the total traffic volume occurred in the space of the few years under consideration. The decrease in accidents following the improvement

EFORE: Peck Road-Valley Boulevard intersection in El Monte, Californio. high incidence of accidents took place at this intersection before a minor nprovement project eliminated uncontrolled left turns from four directions.

AFTER: Peck Road-Volley Boulevard intersection. With left turn channelization, improved signals, etc., the motorist's right of way is more clearly defined. Accidents have decreased 39 percent (from 64 to 39).



is, of course, even more substantial in this light.

A leg-by-leg breakdown of the traffic shows the following increase in volume for the before and after periods:

	Before	*After*
West leg of Valley Boulevard	4,249	4,595
East leg of Valley Boulevard	4,385	4,548
South leg of Peck Road	5,070	6,549
North leg of Peck Road	4,126	5,462
	17,830	21,154

Based on the significant reduction of both the intersecting and approaching type collisions, especially in view of the increased traffic volume, this improvement was considered a successful attempt to better a spot location.

Unfortunately, installing new or more sophisticated signals does not always result in fewer accidents at intersections, although it is sometimes difficult to convince the lay traffic critic of the pitfalls of this seemingly magic formula.

For instance, in a study which evaluated 140 projects in 1962, the overall accident reduction approximated 32 percent. But this total is rather misleading because safety was improved in 108 of the 140 projects. In the remaining 32 cases, the anticipated improvement did not materialize. And, in two-thirds (or 21) of the projects in which the after accident rate was higher, new or modified traffic signals without channelization were involved. In fact, 21 of the 59 new signal projects (36 percent) resulted in a worsening of the accident picture.

Master Evaluation

The outcome of spot improvement projects is forwarded to the Division of Highways Headquarters in Sacramento to become a part of a master evaluation which is carried out by the Traffic Department.

During the calendar year 1964, minor improvements reported by all 11 districts totaled 301. These projects involved a total expenditure of about $8,200,000. About 37 percent of the money was spent for reconstruction. This included easing of curves, widening of narrow roadways, widening of bridges and culverts, increasing sight distances, etc. The next largest expenditure (of the total figure) was for the installation or modernization of traffic signals. The signal projects usually included safety lighting and often the construction of intersection channelization. Substantial sums were also spent for erecting median barriers.

The majority of these safety improvement projects were initiated as a result of the continuous surveillance of the California state highway system for high accident locations, as mentioned throughout this article. The types of projects completed in 1964 are shown below:

TYPES OF PROJECTS

Projects Under Construction or With Design Complete as of December 31, 1964

Types of projects	Projects over $5,000	
	Number	Total cost*
Signals	53	$2,342,900
Flashing beacons	0	
Lighting	0	
Delineation	6	87,800
Guardrail	0	
Channelization	12	382,900
Reconstruction	22	3,410,300
Miscellaneous	10	322,400
Median barriers	2	265,300
Totals	105	$6,811,600

* Includes share of cost borne by local agencies.

It should be mentioned that many other projects were also constructed during the year to improve traffic operation, reduce delay, increase capacity, and the like, but these projects have not been included in 301 projects reported above—unless the locations had experienced adverse accident records prior to the improvement.

At the end of the year, there were another 105 projects, with an estimated cost of $6,811,600 either under construction or with the improvement design completed. Their type and cost is given below:

It should also be noted that many other improvements, which also have a safety aspect, are made on a day-to-day basis by state forces exclusive of the minor improvement program. These include the erection of curve warning signs, the improvement of striping and delineation, and the increase of sight distance by removing shrubbery and other obstructions. Although the cost of any one of these improvements is nominal, the sum total of all such improvements amounts to a substantial safety benefit.

The actual safety benefit which will result from the 301 projects completed in 1964 is only arbitrarily calculable, but projections indicate that about 800 to 1,000 fewer accidents per year should be occasioned. The total reduction during the life of each project

PROJECTS COMPLETED

Jonuory 1, 1964, to December 31, 1964

Types of projects	Projects under $5,000		Projects over $5,000		All projects	
	Number	Total cost*	Number	Total cost*	Number	Total cost*
Signals	42	$48,400	47	$2,350,400	89	$2,398,800
Flashing beacons	17	27,800	1	7,300	18	35,100
Lighting	11	22,800	3	20,800	14	43,600
Delineation	11	10,900	2	49,300	13	60,200
Guardrail	30	50,700	5	103,400	35	154,100
Channelization	23	58,900	17	759,300	40	818,200
Reconstruction	34	78,300	20	2,955,000	54	3,033,300
Miscellaneous	24	55,500	6	110,100	30	165,600
Median barriers	1	4,900	7	1,464,800	8	1,469,700
Totals	193	$358,200	108	$7,820,400	301	$8,178,600

* Includes share of cost borne by local agencies.

Identifying the high accident locations on California's 12,414-mile state highway system is increasingly facilitated through the use of electronic data-processing equipment, as shown by Richard Bjorklund of Headquarters data processing.

would exceed the yearly amount by many times. By averaging the experiences to date, we find that each project can be expected to eliminate about three accidents per year, or about 30 in 10 years.

The present accident reduction through minor improvements is about 25 percent (despite increased traffic volume in the "after" period), as shown in the tabulation below.

It is interesting to note that an earlier survey of the accident reduction attributable to minor improvements showed a 32-percent decline in accidents, but justification for lesser seeming results (25 percent) lies in the fact that the worst locations were improved first. Further studies involving percentages are bound, by the nature of the program, to show diminishing returns.

Type of improvement	Number of projects			Number of accidents per year		Percent reduction in accidents
	Improved	Worsened	Total	Before	After	
New signals	76	49	125	1,125	965	14
Modified signals	14	8	22	485	409	16
New signals with channelization	33	23	56	717	583	19
Modified signals with channelization	34	3	37	824	550	33
Flashing signals	35	10	45	437	338	23
Safety lighting	30	11	41	300	173	42
Delineation	13	0	13	125	69	45
Protective guardrail	9	0	9	45	15	67
Intersection channelization	29	5	34	596	464	22
Reconstruction and miscellaneous	40	10	50	395	237	40
Total of all projects	313	119	432	5,049	3,803	25

With the knowledge on the safety program increasing every year, we do not expect to wrap up the minor improvements program in the foreseeable future. Changes and refinements will occur in the program through project evaluation and research.

Our efforts to improve the techniques of identfying high-accident locations are increasingly aided by the use of electronic data-processing equipment. Computer listings of intersection accidents and accident concentrations in 0.10-mile increments were furnished to the districts in 1964.

Computer Use Expanded

An evaluation is being carried out this year to test the feasibility of greatly expanding the use of computer listings in the minor improvement program. It is expected that these listings will supplement, and in some cases supplant, the present methods of hand posting and visual inspection of accident strip maps. At present, both hand posting and computer listing are carried out, with the comparison of one set of data serving as a convenient cross check for the other.

On the whole, it may be concluded that minor improvements are an effective means of reducing accidents. And, although the number of accidents—before and after—at any one location is usually too small to provide a statistically reliable base, a definite contribution to safety has been proved in all research to date.

The only word of caution to be exercised in a program such as this is that each project should be evaluated on its own unique merits. There is no predictable manner in which to judge the outcome of any particular improvement. Good results, however, can be expected with most projects by using a logical approach to the problem, the solution, and by implementing available funds to carry out the dictates of a soundly conceived working approach.

Governor Edmund G. Brown is shown signing into law Senate Bill 648, which extends the life of the Bay Area Transportation Study Commission for three years. Seated with him at the news conference in the Governor's San Francisco offices on July 12, 1965, is Senator "J" Eugene McAteer of San Francisco, author of the legislation. The interested spectator behind the Senator is Nils Eklund, chairman of BATSC. Newsmen at Governor's right are Earl C. Behrens, political editor of the San Francisco Chronicle, seated; and Vern Williams, radio correspondent, standing.

S. F. Bay Area Transportation Study

By RICHARD M. ZETTEL, Study Director

High in the Berkeley hills a combination of human brains and modern technology is underway with work that will profoundly affect the future of the San Francisco Bay area.

The place is the picturesque Claremont Hotel. The research group is the Bay Area Transportation Study Commission. The goal is the creation of a regional, balanced transportation and land use plan to guide the future of the nine counties which comprise the bay area.

Mindful that population studies indicate a "super-Metropolitan status

for the bay area to rank seventh in the nation in size by the year 2000," the study's basic aim therefore is to get ahead of these developments as far as possible so that meaningful choices, based on factual data, are available to those who must help shape the future.

It was primarily to meet this challenge that the study commission was set up by the 1963 session of the California Legislature. An additional reason was a requirement of the 1962 federal-aid highway law providing that after July 1, 1965, no highway project involving federal aid, be it interstate highway or secondary road, may be approved by the Secretary of Commerce, unless it is based on a continuing comprehensive transportation planning process carried on cooperatively by states and local communities.

The federal law providing aid for transit also requires that "a unified or officially coordinated transportation system as a part of the comprehensively planned development of the urban area" must be developed if the area is to qualify for transit funds.

Total Transportation

Aware that every resource must be called into consideration if its responsibility is to be met, the commission will overlook no possibilities. Be it new freeways, new bridges or more underwater Bay crossings, train, bus, hovercraft, hydrofoil or helicopter, all suggestions will be carefully heard and exhaustively studied. The economy involved is an expanding one and is built upon the free movement of people and goods in and around and through the bay area. The commission's job is to point out what can be done to help future development meet the objectives of all concerned.

Organized on a "grass roots" basis, the 3?-member commission has already attracted national interest. Although it may be somewhat unwieldly administratively because of its size (there is also a 50-member citizens' advisory committee) this same factor is a potential source of great good will, looking to the time when the commission must submit its recommendations to the general public and secure the widespread support necessary for implementation of its proposals.

In the BATSC computer room, Programmers Adeline Bergeron and John Hertz confer on a set of data.

As is well recognized, numerous transportation studies of excellent technical competence have foundered and disappeared or have been relegated to the dust of library shelves because the governmental jurisdictions were not coordinated, or because the attitudes and desires of the general

The children of Carolyn and David Schiller of Orinda help their parents supply information about the family's transportation pattern to BATSC Survey Interviewer Mary Johnson (right).

Staffs of Bay Area Transportation Study Commission and Association of Bay Area Governments work together closely. Left to right, ABAG Executive Director Warren Schmid, ABAG Planning Director James H. Hickey, BATSC Study Director Richard M. Zettel, and BATSC Assistant Study Directors Gibson W. Fairman and Jay W. McBridge.

public were not sufficiently taken into account.

The commission suffers from no such deficiency. It must make practical suggestions on ways of implementing its plan. Its makup is worth noting in some detail.

Commission Makeup

There are seven at-large members appointed by Governor Edmund G. Brown. Four members of the State Legislature, including State Senator J Eugene McAteer of San Francisco, sponsor of the legislature authorizing the commission, also are members. The other legislators are Senator John F. McCarthy, Marin County, and Assemblymen W. Byron Rumford and Leo J. Ryan, of Alameda and San Mateo counties, respectively.

Representatives of the boards of supervisors and spokesmen for the mayors in the nine counties involved in the study also have places on the commission.

Agencies represented include the State Highway Transportation Agency, Department of Finance, Association of Bay Area Governments, Alameda-Contra Costa Transit District, Bay Area Rapid Transit District, Golden Gate Bridge and Highway District, United States Bureau of Public Roads and the United States Housing and Home Finance Agency. The chairman of the commission is Nils Eklund, Vice President of Kaiser Industries, Oakland.

To direct the manifold operations of the study, the commission selected the writer, research economist of the Institute of Transportation and Traffic Engineering of the University of California. Serving as assistant directors are Gibson W. Fairman and Jay W. McBride, both of whom have had extensive experience in regional transportation planning.

Working in close coordination with the commission is the Association of Bay Area Governments. In addition to its direct representation on the commission, ABAG will cooperate in the land use portion of the commission's study and will in fact play a key role throughout the survey. The association has been recognized as a regional planning agency eligible for planning assistance grants by the U.S. Housing and Home Finance Agency. It thus becomes the vehicle through which such financial assistance may be made available to the commission.

In the performance of its basic responsibility to conduct a comprehensive study and to prepare a master regional transportation plan for the future, the commission is explicitly limited to this field by terms of the authorizing legislation. Moreover the commission itself has no powers of decision on contemporary transportation issues, nor does it have powers of review over decisions of other agencies, public or private.

The commission could easily lose its long-range effectiveness if it became embroiled in immediate issues of the day. Progressively as its studies proceed, however, the advisory function of the commission will become more pertinent to current decisions, because the outlines of its plan will begin to emerge.

Initial Work

Standing by itself, the commission's own specific task is a grave and difficult one in a region which is really only beginning to examine its regional problems on an overall basis and to develop articulated plans and means with which to cope with them.

The commission has reached its present status through a succession of steps which may be highlighted as follows:

Acting upon authority conferred by Senate Concurrent Resolution No. 20,

approved by the 1962 session of the Legislature, the State Department of Public Works, assisted by a large bay area committee of technical and citizens' representatives, prepared a prospectus setting forth broad general lines along which such a study could proceed.

Senator McAteer then introduced legislation creating the commission. The law took effect in September 1963, but it required some months before all 37 commissioners could be appointed by the many agencies and governmental jurisdictions concerned. The full commission thereupon held its first session in Oakland on March 20, 1964.

The study director was appointed in June, and in August the commission approved a cooperative agreement with the Association of Bay Area Governments and the State Highway Transportation Agency to "provide organizational and working arrangements for a continuing, coordinated, comprehensive planning process in the San Francisco Bay area."

In October the commission approved and adopted the preliminary study design prepared by the technical staff. During December the commission moved its financing arrangements to the final stages. (The authorizing legislation did not provide for any direct operating funds for the commission and negotiations for this purpose occupied many weeks.)

Approximately $3,465,000 has been set as the amount which will be needed to complete the study, which is now scheduled for early in 1968.

These funds will come from a combination of federal, state and local sources, with the federal government accounting for the greatest portion.

Thus, with major problems of organization, financing and staffing behind it, the commission has moved rapidly into the vital data-gathering and analysis phase of the study in this effort it is working closely with the many existing planning and transportation agencies operating in the bay area. These include both District 4 and the Urban Planning Department of the State Division of Highways, the State Division of Bay Toll Crossings, the Golden Gate Bridge and Highway District, the Bay Area Rapid Transit District, the Alameda-Contra Costa Transit District, the San Francisco Municipal Railway, the West Bay Rapid Transit Authority, and the Marin County Transit District; all in addition to planning and transportation agencies of the individual counties and cities.

Existing Studies

Actually, a considerable amount of excellent transportation planning has already been done in the bay area. But it has often been fragmented along political or geographical lines or limited to a particular mode of transportation. All usable information from past studies, as well as from present planning programs, will be incorporated in the current study. But a vast amount of new data must be collected and collated if the commission is to meet its goal.

A truly comprehensive study requires "that the economic, population,

Morning inbound traffic from Contra Costa County approaching the Caldecott Tunnel.

Peninsula commuters boarding San Francisco-bound train at Polo Alto.

and land use elements be included; that estimates be made of the future demands for all modes of transportation both public and private for both persons and goods; that terminal and transfer facilities and traffic control systems be included in the inventories and analyses . . ."

Field Surveys

Many field surveys are being undertaken concurrently. These will include traffic counts and interviews along roadsides and in buses; inventories of road, transit, and parking conditions; studies of truck, bus, and taxi operations.

One of the most important surveys is the home interview, which involves personal contact with selected families concerning trips made and characteristics of the household. In excess of 50,000 households will be interviewed, the list having been selected at random to cover all geographical areas and all kinds of families.

All information obtained is held confidential, of course, and will be used only in statistical summaries which will explain present travel patterns and help in prediction of the future.

The land use survey which will be accomplished largely through analysis of aerial photographs will be of great interest for general planning as well as transportation analysis. Complete aerial coverage of the study area is now being acquired in a form suitable for enlargement to a 1-to-200 scale. The land use survey will be supplemented by floor area surveys.

Computer Use

All of the data mentioned, along with information from still other surveys, will be fed into an IBM 1401 computer at the commission's headquarters for summarization and subsequent analysis. A study of this scope and depth would be impossible to accomplish manually. Literally tens of

millions of individual items of data are involved.

One of the important byproducts of the commission's work will be the ability to furnish information to other transportation and general planning agencies quickly and in the form desired, so that they may take advantage of the commission's vast store of data in their own programs.

A second important feature is that an adequate historical base of information will be established which will allow the commission and other planning bodies to analyze the impact of decisions made in the future. For instance, with the frame of reference now being accumulated it will be possible to gauge accurately the impact of future rapid transit on bay area development.

Weighing Alternatives

However, the main objective is to develop an acceptable and practical comprehensive transportation plan. Analysis of current data will permit the development of models or mathematical expressions which reproduce current travel and land use patterns. These will then be used in prediction of the course of future development of the bay area and the resulting transportation demands.

Once the basic analyses are completed it will be possible to develop alternative plans of land use and transportation development and descriptions of the public policies needed to bring them about. The alternatives will be submitted to the commission for evaluation and public debate in light of the goals and aspirations of the region. Finally, a preferred regional transportation plan will be selected by the commission for recommendation to the Legislature.

Briefing Sessions

While the technical work proceeds, the commission is going forward with more generalized aspects of the study so that it may make a more informed choice among possible alternatives at the appropriate time.

Planned for action in the near future is a "briefing" on the so-called "novel" transportation methods, some of which were mentioned earlier. Also scheduled is a meeting to hear from representatives of business, labor and civic groups. The general public will also be invited to put their viewpoints before the commission. These meetings will continue and expand a program of meetings held by the commission at various localities during 1964, when federal, state and local officials reported on the current status of transportation facilities and planning for the bay area.

Among several important innovations in the commission's organizational setup was the provision for a 50-member citizens' advisory committee. Under the chairmanship of Stanley E. McCaffrey, president of the San Francisco Bay Area Council, this group is fully organized and has held a joint meeting with the commission. The advisory group is expected to play an active part in the entire study, both in the formulation of the commission's final recommendations and in helping to obtain public support for the proposals.

Long-ronge Planning

The goal set for the commission—to design a balanced transportation system that will serve the nine bay area counties efficiently in the 1980's, the 90's and beyond—may be thought to be too remote to be practical.

However, one or two points should be kept in mind in relating the work of this commission to the future transportation system in the bay area.

Foremost is the fact that the commission does not intend to set up any arbitrary and rigid plan, put a date of 20 to 25 years from now on it, and call it quits.

What it is aiming for is to set up some basic goals and general guidelines, to make specific recommendations within that framework, and to make provision for periodic review and updating, probably at five-year intervals.

This last is most important. The commission itself is temporary, but it must, as a part of its responsibility, make adequate plans for transfer of its planning functions to appropriate permanent agencies.

It is believed that the people of the bay area are going to be much more disposed to support the commission's long-range suggestions if they know they are flexible enough to accommodate factors that may not be seen clearly enough today.

Commuter parking lot for freeway bus connection at Orinda, Contra Costa County.

Aerial photos are a major tool in the land use survey of the bay area. Intermediate Clerk Mary Henderson is shown making measurements on a photo preparatory to calculation of enlargement factors.

The important thing is to set the stage now for a continuing process that will help to shape the bay area into an increasingly desirable place in which to live as our population grows and the economy expands. An adequate job of transportation planning, properly coordinated with other planning efforts, will do much to assure a pleasant future.

Home interviewers undergo extensive training. Instructor Louis Nackos is shown conducting one of the classes.

APOLOGIES TO MR. LITTLETON

On page 17 of the January–February 1965, issue of *California Highways and Public Works* magazine the photo of the piece of paving falling into the gap of the washout at Mears Creek on Interstate 5 was credited to the maintenance foreman of that section.

Actually the picture was taken by Ray E. Littleton, son of the maintenance foreman, who is a member of the Redding Fire Department, Fire Hall No. 2, 1900 Placer Street, Redding.

The photo was made with a Polaroid camera, in alternate rain and snow squalls. The referred to picture and two others made by Mr. Littleton at the same time appear below.

Right-of-Way Agents Hold 3rd Academy

The third two-week summer training academy for Division of Highways Right-of-Way Agents was conducted August 2–14 at the University of California's Davis campus.

Approximately 90 of the division's junior agents and some of its newer assistant agents from the state's 11 highway districts attended this concentrated 88-hour course of technical training in property acquisition and related fields.

In California's highway program, most of the land required for freeway and highway construction is purchased from private owners. Right-of-way agents are responsible for appraising these properties, negotiating their purchase, and managing them until construction begins. In the 1964–65 fiscal year, approximately 7,500 such transactions were made, representing an expenditure of nearly $180,000,000.

"As a concentrated extension of our comprehensive in-training program, the academy's value has been proven through a higher level of productivity on the part of our agents, who already represent the top 10 percent of applicants for a right-of-way career," said J. C. Womack, State Highway Engineer. "This is in turn reflected by savings in both time and money, since it speeds the translation of highway user taxes into safe, modern highways and freeways.

"Also, because right-of-way work is extremely varied, our agents must supplement technical knowledge of real estate laws and values with recognition that rights of the public and the property owner must be protected. Agents must merit the public's confidence and good will through care, courtesy, and constructive cooperation."

Classroom sessions incorporated: The Right-of-Way Function; Basic Engineering; Appraisal Theory; Acquisition Law and Techniques; Property Management; and Administration.

Senior members of the division's right-of-way staff served as instructors. Group conferences were scheduled as evening sessions. Classes were held in the Physical Sciences Building and Olson Hall on the Davis campus, and residence was in Ryerson Hall.

Rudolf Hess, Chief Right-of-Way Agent for the Division of Highways, supervised plans and curriculum for the academy, which offered opportunity for a uniform instructional pattern for agents who will apply this training in their respective districts throughout the state.

Rotation Involves Key Assignments

Job rotation within the Division of Highways is mandatory only at the junior civil engineer, or entry, level. Its advantages were described in an article in the May–June 1963 issue of *California Highways and Public Works*.

In some districts the rotation policy has been increasingly applied at higher levels of responsibility, and for the same reasons: to broaden the engineer's base of experience, and to provide better qualified highway leadership for the future.

In recent months the division's two largest districts have carried out major shifts of assignments, one involving Assistant District Engineers (supervising level) and the other involving Senior Highway Engineers.

In District 4, San Francisco, a series of such changes involved eight Assistant District Engineers. Some of the moves were from traffic to administration, from construction to design, from planning to maintenance, and from right-of-way engineering to programs and budgets. Several of the men involved had held their previous assignments for many years.

More recently, seven of the Senior Highway Engineers in District 7, Los Angeles, were reassigned to new duties in different units. For example, the new administrative head in the district maintenance office is a transfer from the programs and budgets unit. Other lateral changes involve route planning, design and materials units.

Baynard A. Switzer, Safety Head, Leaves

Baynard A. Switzer, Safety Engineer for the California Division of Highways, retired on August 31, after a 41-year career with the state.

As head of the Safety Section since 1955, Switzer has had charge of all industrial and traffic safety and fire protection for the division's now more than 17,000 employees. He has also supervised the division's Merit Award Program.

BAYNARD A. SWITZER

The 27-year-old employee safety program has brought outstanding reduction in accident rates and costs among division personnel. Under Switzer, the rate of recordable motor vehicle accidents among highway employees has been reduced by one-third, the lost time injury rate by more than one-half.

Prior to his appointment as Safety Engineer, Switzer also played an important role in the division's research program on traffic signing, pavement marking and speed zoning.

Switzer was born at Fredalba (now Smiley Park) north of San Bernardino and went to grade and high school in Highland and San Bernardino. He later studied engineering at Oregon State University.

He joined the Division of Highways in 1924 as an engineering draftsman.

He was appointed district traffic engineer at San Bernardino in 1940.

He transferred to the headquarters office in Sacramento in 1950 as an assistant traffic engineer.

Switzer is a member of the Institute of Traffic Engineers. He is a Mason, a member of the State Men's Club and is past regional director of the California State Employees' Association.

Switzer is married and has a son, Robert, and a daughter, Barbara N. Cullen, both of Victorville.

District 3 Loses Maintenance Chief

R. I. Nicholson of Yuba City has retired from the California Division of Highways August 1 terminating a 35-year state engineering career.

For the past 15 years he has been district maintenance engineer supervising a staff of 400 in the upkeep and repair of 1,400 miles of state highways and freeways in the 11 counties served by the Marysville district office.

R. I. NICHOLSON

Succeeding Nicholson will be Elmo C. Meister, a senior highway engineer who, for the past two years, has headed the locations department charged with mapping adopted routes for future freeways.

After the 1955 Marysville-Yuba City floods, crews under Nicholson's direction were cited for their excellent work in re-opening state roads and making emergency repairs.

Born in Shasta County, he attended the University of California in Berkeley majoring in civil engineering.

In 1930, he joined the Division of Highways in Marysville, and has spent his entire career in District 3 with the exception of a two-month assignment in Sacramento headquarters.

He was promoted to senior highway engineer in 1950. Before promotion to his present position, he was in charge of the district's federal aid secondary system of roads.

He is state president of the Quarter Century Club of the Division of Highways and is past president of Chapter 40 of California State Employees' Association.

He helped organize the highway district's safety committee and was its first chairman.

Nicholson served as chairman of the Sutter County rehabilitation committee, formed after the 1955 floods.

He is a member of the Elks Lodge, Marysville, and the James Marshall Chapter of F. Clampus Vitus.

He and his wife, Mary Frances, have two daughters, Mrs. John Wilkins of Tahoe Valley and Mrs. Floyd Brockman of Stockton, and four grandchildren.

DEPARTMENT LOSES 29 MEMBERS TO RETIREMENT

District I

Vernon A. Martin, highway maintenance man II, 38 years.

District II

Lester F. Ball, senior highway foreman, 43 years; Frank F. Dais, highway maintenance man III, 42 years.

District III

Andrew T. Hartley, Groundsman, 10 years.

District IV

Bert P. Bongera, assistant highway engineer, 36 years; Howard C. Farris, senior highway engineer, 38 years; Helen M. Horne, intermediate clerk, 27 years; Ralph D. Kinsey, supervising highway engineer, 41 years; Carl R. Klinkenberg, assistant highway engineer, 19 years; F. W. Montell, supervising highway engineer, 41 years; Paul M. Morrill, assistant highway engineer, 34 years, George M. Pimentel, highway maintenance man II, 32 years; Charles M. Thornton, skilled laborer, 11 years.

District V

Udo M. Jante, delineator, 12 years; Owen F. Maxham, intermediate clerk, 5 years.

District VI

Ellsworth I. Van Patten, associate right of way agent, 34 years.

District VII

Charles C. French, highway engineering associate, 38 years; Abe Givens, groundsman, 9 years; Frank D. Gore, associate highway engineer, 14 years; William V. Hesp, highway engineering associate, 17 years; David A. Stewart, highway maintenance man II, 12 years.

District VIII

Donald S. Wieman, highway superintendent, 34 years.

District X

Violet L. Rosa, intermediate file clerk, 7 years; Dolph J. Vergara, automobile mechanic, 35 years.

District XI

Harold D. Martin, highway tree maintenance foreman, 28 years.

Headquarters Office

Martha E. Harris, senior clerk, 22 years.

Bridge

Elynor A. De Regne, supervising clerk I, 19 years; Edward M. Derby, associate bridge engineer, 28 years.

Shop 8

James R. Mackie, automobile mechanic, 21 years.

IN MEMORIAM

District I

Gerald L. Belak, highway maintenance man II.

District IV

Ah Y Fong, assistant highway engineer.

Edward J. Riordan, engineering student trainee—Range C.

District VII

Carl U. Bliss, assistant highway engineer.

Emory Douglas, janitor.

Clarence F. Gurss, assistant highway engineer.

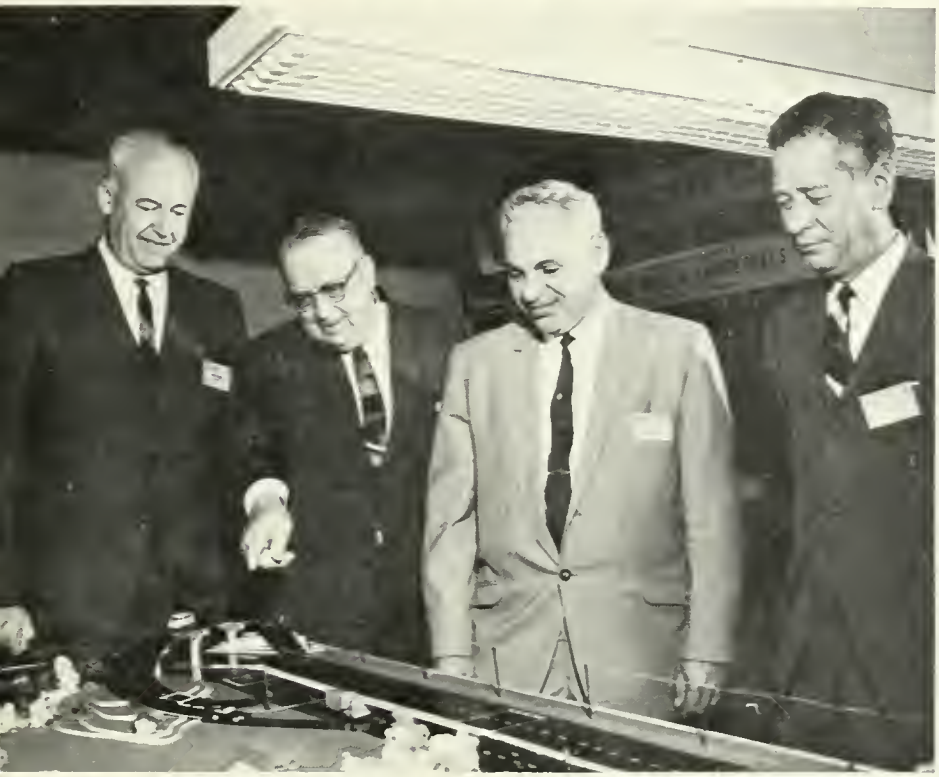
District XI

Fred Young, highway maintenance man III.

Shop 7

Charlie B. Warner, machine parts storekeeper.

HIGHWAY COMMUNICATIONS MEN MEET IN CAPITAL



Representatives of 30 states with an interest in highway communications met in Sacramento on June 22–23 to discuss new developments in this field. The conference was sponsored by the Subcommittee on Communications of the Committee of Administration, American Association of State Highway Officials. Inspecting one of the exhibits are, left to right, Assistant State Highway Engineer Lyman R. Gillis of California; State Highway Engineer Virden E. Staff of Illinois, chairman of the subcommittee; Communications Engineer Arnold H. Carver of California, conference chairman; and W. D. Dillon of the Research and Development Division, U.S. Bureau of Public Roads.

Langsner Reelected To WASHO Office

Deputy State Highway Engineer George Langsner, California, was re-elected secretary-treasurer of the Western Association of State Highway Officials in June at the concluding session of the association's 44th annual conference, held in Santa Fe, New Mexico.

Langsner will serve with State Highway Engineer Charles E. Shumate of Colorado, elected president for 1965–66, and Washington State Director of Highways Charles G. Prahl, vice president.

In addition to these three officers, the executive committee of WASHO includes S. N. Halvorson of the Montana State Highway Commission; Chief Highway Engineer T. B. White of New Mexico; William K. Holbrook of the Arizona Highway Commission; Superintendent and Chief Engineer R. G. Stapp of the Wyoming Highway Department; and State Highway Engineer D. C. Greer of Texas.

Idaho will be host state for the 1966 meeting.

Kozak Promoted To Deputy Chief Post

Appointment of John J. Kozak as deputy chief engineer of the Division of Bay Toll Crossings was announced recently by E. R. Foley, chief engineer.

Kozak, 44, an engineer for the State of California since 1947, came to Bay Toll Crossings last November as a principal bridge engineer.

In his new capacity, Kozak will assist Foley in administering the division, which has a statewide responsibility for operation, design and construction of toll bridges.

Frederick Montell Retires in District 4

Frederick W. Montell, assistant district engineer in District 4, retired on June 1, 1965, after more than 41 years of service with the Division of Highways—40 years of which were in District 4.

A native of San Francisco, Montell was raised and schooled in Fresno, studying civil engineering at Fresno State College.

He joined the Division of Highways in July 1923 as a chainman on a location survey party on the Yosemite All-year Highway in the Merced River Canyon and has been continuously associated with the division in a variety of engineering assignments since that time.

FREDERICK W. MONTELL

Montell was assigned to construction from 1933 to 1948, on major projects in the bay area. One of the jobs involved the East Bay approaches to the San Francisco-Oakland Bay Bridge.

From 1948 to 1960, Montell was head of cooperative projects with the ratings of senior and supervising highway engineer. On January 1, 1960, he was reassigned as head of the Survey and Materials Department, a position he held until his retirement. The department was reorganized in 1962 as the Engineering Services Department.

Montell is a member of the American Society of Civil Engineers, the American Public Works Association, and the East Bay Engineers. He is also a past master of his Masonic Lodge, past president of Chapter 5, CSEA, recipient of the Samuel A. Greeley Service Award in 1954, and a member of the Commonwealth Club.

He and his wife, Cora, have a son, Robert, of Pleasantville, New York, and a daughter, Shirley (Mrs. William Soares), of San Leandro, California.

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District 7, Los Angeles

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PCI AWARDS OF MERIT FOR TWO CALIFORNIA BRIDGES

The Prestressed Concrete Institute has bestowed award of merit plaques on two of California's bridges: the MacKinnon Avenue Overcrossing on Interstate 5 north of San Diego and the Vincente Creek Bridge on Highway 1 some 50 miles south of Monterey. The PCI makes its awards annually to recognize creative design using prestressed concrete.

The awards take into account originality of architectural or engineering design, techniques of assembly, effective employment of the properties of prestressed concrete and aesthetic appearance.

Two of the 10 nationwide awards offered by the institute in 1964 were also won by California bridges when awards of merit were presented for the Willow Creek Bridge on the Coast Highway 65 miles south of Monterey and by three prestressed carrying beams over the Arroyo Seco flood control channel in Los Angeles. (See July–August, 1964, issue of the magazine.)

Structure site of the Vincente Creek Bridge on Highway 1 south of Monterey is a steep canyon on the coast in an area noted for its rugged beauty. Designers endeavored to integrate it with the environment and offer a minimum of visual detraction from the natural surroundings.

The simple, neat lines of the MacKinnon Avenue Overcrossing on Interstate 5 north of San Diego were felt to be aesthetically appropriate in this particular area on the state's scenic highway system. The prestressed design is a two-span continuous box girder with unbonded wire tendons.

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CALIFORNIA highways and public works

SEPTEMBER-OCTOBER 1965

Temporary Gas Tax Off

January 6, 1965

August 31 was the cut-off date for the one-cent gas tax Californians paid to reconstruct roads in the north of the state that were damaged in the Christmas floods of 1964.

Governor Edmund G. Brown eliminated the tax four months before the legal expiration date. Including federal funds for emergency relief, $67 million has been raised.

Typical of restorations in progress are these views of the Eel River Bridge at Rio Dell, Humboldt County.

ABOVE: February 26, 1965

BELOW: August 19, 1965

California Highways and Public Works

Official Journal of the Division of Highways, Department of Public Works, State of California

VOL. 44 September-October Nos. 9–10

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Address communications to: EDITOR,

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

P.O. Box 1499

SACRAMENTO, CALIFORNIA 95807

FRONT COVER: These two aerial views are "before and after" aspects of U.S. 99 in Modesto, with the right hand picture showing the new freeway opened this summer. Landscaping will be effected in a later contract. Both photographs by William Chaney.

BACK COVER: One of the glories of the high country is the quaking aspen in fall. This grove overlooks State Route 89 in the Monitor Pass region. Photography by John Meyerpeter.

Airspace

State Groups Plan for Over and Under Freeway Use

By AUSTIN R. DOYLE, Information Officer

"California is gaining 1,750 persons a day. By 1980, we are convinced that the resulting land shortage will force us to build over and under freeways for nonhighway purposes whether we plan now for that use or not."

The speaker was Robert B. Bradford, administrator of the Transportation Agency and chairman of the California Highway Commission, addressing a meeting of federal, state, county and city officials in Sacramento on July 20, called to identify the many possible beneficial uses of such freeway airspace and to tap the reactions of local governing bodies.

In the discussion which included mention of apartments, office buildings and restaurants above freeways, and city and county buildings as well as parking lots below them, Bradford added, "We are not talking of any total use of this airspace, but rather, the selected development of this property, sensitively done in selected areas."

He said that this can be accomplished only by the teamwork of state, cities and counties, and that all such construction must conform to the zoning of local government.

Quick support of a program for planning the best use of freeway airspace was pledged by Richard Carpenter, executive director of the League of California Cities, and Vincent Cooper, assistant general manager of the County Supervisors Association.

Bradford made clear that the purpose of the discussion was both to discover how to fit the use of freeway airspace into a program of community betterment as well as "to find how to lease this space for long terms to put tax dollars back on the assessment rolls for the 1 to 3 percent of assessed valuation taken by freeways from the cities and counties."

He added that although freeways do take land from tax rolls, California's experience has shown that they so increase the value of adjacent land that they benefit the community taxwise.

Back in 1962, Governor Edmund G. Brown had said that the State would take advantage of new federal regulations relinquishing airspace rights on Interstate freeways to the states concerned.

Governor Edmund G. Brown summed up the potential of airspace recently when he said, "The sky's the limit."

"Sky Is Now the Limit"

"The sky is now the limit, in a very real and practical sense, on combining freeways with every type of beneficial use," he said. "I can visualize public buildings, hotels, apartments and recreational facilities straddling our below-ground freeway sections, and additional parking, commercial and other uses beneath the viaduct areas."

Bradford stated that the meeting was in harmony with the Governor's philosophy that maximum value must be extracted from all state-owned lands if California taxpayers are to receive fair treatment.

He said that highway transportation planners realize that material benefits exist if land can be used for more than one purpose and the state is ready to promote double or triple use wherever feasible.

Indeed, the sky is really the limit, judging by the diverse experiences of communities in other states.

In Hartford, Connecticut, for example, a public library has been constructed over an expressway; in Chicago, an expressway lances smoothly through a post office building; a $14 million bus station straddles an interstate expressway in New York City, and four 32-story apartment buildings have been built over this same route, the freeway approaches to the George Washington Bridge, spanning the Hudson River to New Jersey.

New York City sold at auction, rather than leased, the rights to the airspace for two city blocks above this freeway for $1,065,000. In this airspace, the developers invested approximately $19,600,000 for the housing of 960 families, more than three times the taxable value of the previous property, giving the city a higher tax return than before the buildings were removed to permit the freeway's construction.

Speaking before the American Association of State Highway Officials' Committee on Legal Affairs in 1962, H. J. Morton, assistant general council of the Bureau of Public Roads, said that contrasted with outright sale, "the leasing of air rights can be even more profitable over the long run, especially in those states, which, like California, can tax leasehold property; also the state retains a reversionary interest and has the benefit of the continuing income from the lease rental and any appreciation in value over the years."

Pasadena Freeway

Boyd P. Welin, vice mayor of Pasadena, representing six California communities at the Sacramento meeting, said that Pasadena was considering decking over the Pasadena Freeway near the new Blair High School to provide for tennis and handball courts and other campus activities.

He added that such use of freeway airspace would prevent the necessity of taking adjacent properties from the tax rolls.

Welin, accompanied by City Manager Elder Gunter, presented models showing proposed airspace development over and under future freeways in his city.

Some of his proposals included heliports above freeways, a city park atop the north-south (Long Beach) freeway under Colorado Boulevard, and green spots to beautify the city in areas zoned for industrial use.

After Walter Hahn, Jr., assistant city manager of San Diego, suggested that cities take inventory of their needs for airspace and present plans to the state, rather than waiting for the state to take the lead in planning, the City of Stockton and San Joaquin County were singled out for their planning now—years before construction—for the possible use of land under the future Crosstown Freeway in Stockton as the site for public buildings.

California's experience in leasing airspace dates back to 1942 when areas under the San Francisco approaches to the San Francisco-Oakland Bay Bridge were rented for parking purposes.

First Use of Airspace

The first use of airspace under freeways was in 1954 when areas for parking were leased under San Francisco's Bayshore Freeway. Today, such leases exist for space under the Bayshore, Central and Embarcadero Freeways in San Francisco; the Nimitz and MacArthur Freeways in Oakland; and the Santa Monica Freeway in Los Angeles.

Additionally, the Division of Highways has maintenance stations under the Bayshore and MacArthur Freeways, and the City of Oakland dispatches police emergency vehicles from a location under the Nimitz Freeway near its Hall of Justice.

Legislation passed this year by California's Legislature provides for such use by emergency vehicles at no cost to local governments.

In an article in *American Highways* in 1954, former California State Highway Engineer George T. McCoy said that space beneath freeways must be put to sound and practical use, especially within the centroid of metropolitan areas where land scarcity causes parking facilities to be at a premium or nonexistant.

McCoy revealed that the Division of Highways had studied the feasibility of substituting a viaduct structure for a fill on a section of the downtown Harbor Freeway in Los Angeles to develop parking space underneath.

An attempt was made to enlist the various central business district organizations in the creation of parking lot districts to make up the difference in cost between the planned fill construction and a viaduct, so that the space beneath the freeway between 7th and 12th Streets could accommodate about 4,000 parking spaces.

However, local interest and cooperation were not spontaneous, and the acute traffic congestion in downtown Los Angeles would not permit delay in the construction of the Harbor Freeway.

First Limited to Parking

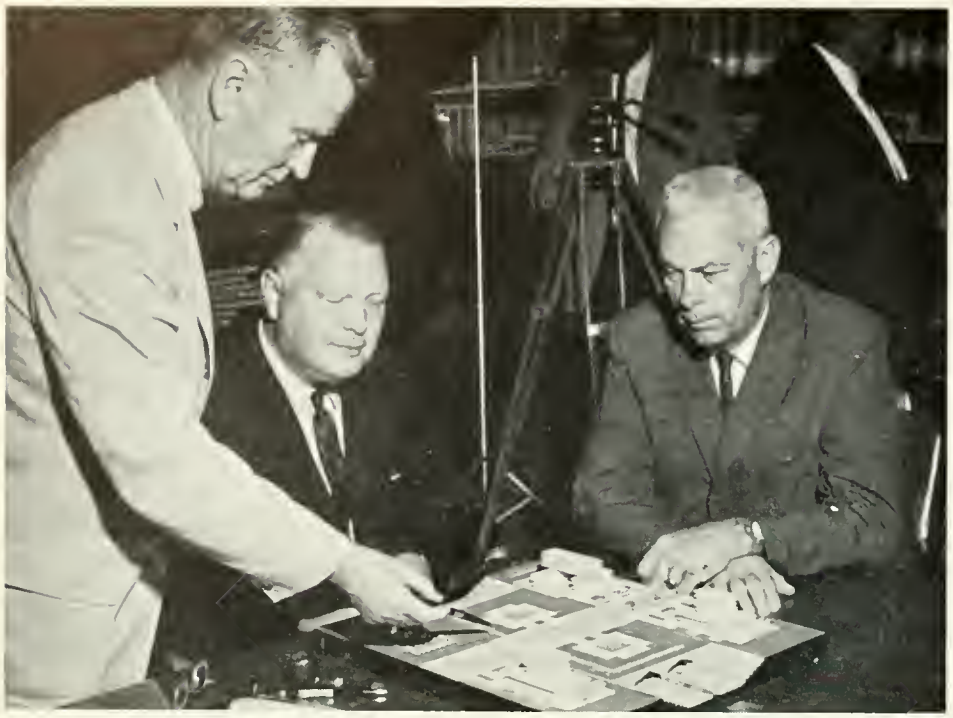
When the National System of Defense and Interstate Highways was instituted in 1956, the use of airspace was limited to parking by public agencies. California led the attack to remove this restriction.

When a fraternal order offered to lease space under Santa Monica Freeway (Interstate 10), the Federal Bureau of Public Roads, although in sympathy with the state, had to rule against it.

Since California estimated that she eventually might realize millions of dollars from private parking leases, and since under California law possessory interests under leaseholds are subject to local taxation, the state in 1961, with American Association of State Highway Officials support, proposed an amendment to permit the use of interstate airspace by private interests.

The Subcommittee on Roads of the House Committee on Public Works not only recommended favorable action, but proposed further liberalization of the law to permit airspace use for nonparking purposes, subject to

Members of the Senate Fact Finding Committee on Transportation and Public Utilities which considered the problem of freeway airspace development at its meeting in San Francisco on August 18 are shown (left to right): Senator Fred Marler, Jr., Shasta-Trinity; Mrs. Helen Winslow, committee secretary; Senators Luther Gibson, Solano; Richard Dolwig, San Mateo; John Schmitz, Orange; Randolph Collier, Del Norte-Siskiyou, committee chairman; Carl Christensen, Humboldt; and Stan Pittman, Butte; William Scheuermann, committee consultant; Emerson Rhyner, deputy chief of the Division of Contracts and Rights-of-way, and Rudy Hess, head of the Right-of-way Department of the Division of Highways.



Boyd P. Welin, vice mayor of Pasadena (standing), shows Transportation Agency Administrator Robert B. Bradford (center) and Pasadena City Manager Elmer Gunter a model illustrating some of the uses of freeway airspace under consideration in his city.

conditions relating to the free flow of traffic and rules and regulations of the Secretary of Commerce.

This was passed and signed into law in June, 1961.

Wide Ronge of Regulotions

The wide range of regulations applied by the Secretary of Commerce through the Bureau of Public Roads included provisions that forbid federal financing of any added costs for proposed airspace use, beyond the normal cost of freeway construction; that forbid automotive service stations or other commercial establishments for servicing the motor vehicle users to be constructed on the right-of-way; that require state and Bureau of Public Roads approval prior to the beginning of construction of the nature and term of the proposed use, the general design of facilities, and advance arrangements for emergency maintenance procedures.

The regulations also concern such design features as the amount of space between the top of a building under a freeway and the bottom of the structure, adequate ventilation, fireproofing, on-premise signs and displays, and terms of lease, including restoration of the airspace to satisfactory conditions when use is ended.

Present authority for California to lease airspace is contained in Section 104.12 of the Streets and Highways Code (1961), which permits the Department of Public Works to lease the use of areas above and below state highways to public agencies or private individuals, subject to such reservations and conditions as the state deems necessary to protect the safety of the highway and abutting and adjacent property.

This code section authorizes the Highway Commission to prescribe the leasing procedures.

Commission's Policy Exploined

At the July 20th meeting, Chairman Bradford explained the commission's policy of using an "offer and proposal" format for awarding leases involving building improvements to private interests, rather than standard competitive bidding procedures.

"This procedure has been used successfully by many Redevelopment Agencies," he said. "It calls for the developer to submit his plans and his offers of payment for our consideration. We are free to consider what the local community most desires—what will do the most for our people—rather than being bound to accept the highest bid."

A California Highway Commission resolution of December 1964 made extensive changes in previous policy, Bradford said. Before, leases were limited to five years and the construction of building improvements was prohibited.

"Naturally, with the new concept of putting the land occupied by our freeways to multiple use, our leases must be for periods sufficient to amortize building costs. Such leases could easily run 51 or more years."

The first bid received under the new offer and proposal format was opened in June. A developer has proposed the construction of an office building above the Webster Street Tube in Oakland on Route 61.

Another development under discussion which would involve a long term lease is the proposal to construct a U.S. Post Office under the "W-X" (Interstate 80) Freeway in Sacramento.

The Transportation Agency administrator said that the new procedure will require substantial preliminary investment by the prospective lessees and extensive analysis and investigation by the State Department of Public Works and local agencies. The department is charged with recommending the award of airspace leases to the commission for approval.

Instructions to Districts

State Highway Engineer J. C. Womack has described the instructions sent the 11 highway districts implementing the commission resolution.

In brief, the appropriate district must notify the State Highway Engineer of any inquiries, plans or proposals for the construction of building improvements under or over freeways, and prior to using the offer and proposal format, submit a report justifying consideration.

The report must state that the proposal will not conflict with any highway changes which may be necessary in the foreseeable future; that it has been discussed with local authorities

and is not in conflict with local planning or zoning ordinances.

Should this preliminary report be approved, the district will prepare brochures describing the space to be offered for lease, the conditions of use, and minimum acceptable offers if necessary. It also will advertise widely the availability of the brochures and offer and proposal forms to assure reaching potential developers.

Following receipt of the completed forms, they will be evaluated carefully by the District Design and Right-of-way Departments, then the advice of the Bridge Department and the State Division of Architecture will be secured as to the compatibility of the building with the highway design.

Each development proposal must be discussed with the technical staff of the local government and its written comments obtained.

Districts Will Submit Reports

Finally, the district will submit its complete report to the State Highway Engineer, who in turn will evaluate all proposals and recommend suitable action to the Highway Commission.

During the July meeting several representatives of cities and counties spoke of the commission resolution which requires that proposed uses of airspace be in agreement with local zoning regulations. Some observed that such use might not be in conflict with zoning but still be objectionable to the local government. Bradford gave assurances that the state will not permit any use within a community against its wishes.

"Again I emphasize," he said, "although we would like to receive rental revenues and get many improvements on the local tax rolls, we are not concerned with the high bid. What we want are imaginative plans that can be carried out for the benefit of all."

Somewhat similar meetings will be held in southern California, the San Francisco Bay area, and at a third site to be selected.

Bradford's mention of rental revenue brings into focus a conflict in views between the state and the Bureau of Public Roads concerning the division of such income.

The U.S. Comptroller General, when asked in 1962 if the Bureau of Public Roads could require the states to pay a pro rata share of the net proceeds of airspace rentals, doubted that the payments could be required.

He referred to the legislative history of the bills concerning airspace and said that Congress did not consider the question of division of income although it knew that income would be forthcoming.

As a result of this decision, the Bureau of Public Roads Instructional Memorandum of March 21, 1962, provided that the "disposition of income received from the authorized use of airspace will be the responsibility of the states."

Complexities of Use

The complexities of the use of freeway airspace are enormous. How to have the freeway serve its principal function, the movement of traffic, while involved with building improvements which might affect an adjacent property owner's rights to light, air, view and access, and please or displease the local community, will require major decisions.

These must be made.

President Johnson told the mayors of many cities whom he invited to witness the signing of the bill creating a new cabinet post for urban affairs, that in 35 years the trend to urbanization will cause the need for as many homes, schools and office buildings to be constructed in cities as exist today.

Several years ago, the *Wall Street Journal* cited the advantages of constructing modern offices and apartments, using air rights in prized central locations.

Discussing development over railroad tracks or other low-lying facilities, the *Journal* reported the developers' belief that high rental incomes more than compensate for the extra cost of construction.

The developer does not have to go through "the tedious process of assembling several adjacent plots, demolishing existing buildings, and perhaps, relocating tenants. Instead, he can often pick up a large site in one transaction."

Freeway airspace development predictably will become of increasing public interest. A Division of Highways news release reporting the meeting of July 20 was printed by a majority of the state's press.

California's Legislature is interested in the problem. The Senate Fact Finding Committee on Transportation and Public Utilities considered it at its meeting in San Francisco on August 18. This committee intends to hold public meetings in metropolitan areas on the matter.

As Governor Brown said, "the sky's the limit."

Shown is a model of possible building development above a depressed freeway (left to right in center). The section illustrated is in the "Golden Triangle" area of Beverly Hills.

Modesto Freeway

By WALTER E. CURTIS,
Project Engineer

PHOTO ABOVE: The new freeway makes sweeping curves as it crosses over old Highway 99 (foreground) and 7th Street and under Crows Landing Road south of Modesto. PHOTO BELOW: Concrete ribbons provide safe traveling for the motorist over and under once-hazardous intersections and railroad tracks.

Traffic began using the new six-lane, nine-mile Highway 99 freeway through Modesto and Ceres on June 30, 1965.

Opening of the freeway eliminated the slow, bumper-to-bumper pace on busy 9th Street through Modesto and the signalized cross traffic through Ceres. It culminated more than 14 years of studies and planning, and three years of construction work.

Origin and destination studies began in 1948. Local officials and interested citizens participated with enthusiasm in the planning of alternate route studies. By 1952, their help and cooperation was reflected in the final freeway route which was ultimately adopted by the California Highway Commission. Their continued assistance resulted in a freeway designed to facilitate the flow of local traffic, while permitting the through motorist an uninterrupted and safe trip.

Bottleneck Eliminated

Today's motorists are now enjoying the benefits of this teamwork, whether they travel safely and easily through Modesto and Ceres or select one of the many conveniently located exit ramps to enjoy the hospitality of these growing agricultural and industrial communities.

At the same time, thousands of local residents are now enjoying the ease of shopping in town. They cross over the new freeway on any of these strategically located bridges rather than wait for a long freight train to pass, or fight their way through the heavy truck traffic which formerly went through their cities on what is now known as "Business US 99."

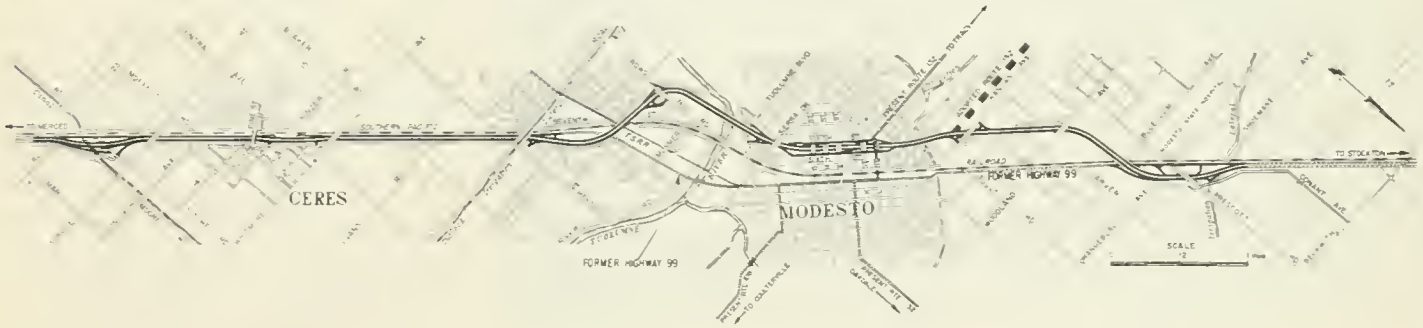
Highway 99 no longer acts as a traffic barrier, separating the east from the west, but instead it is bringing these sections of town closer together by means of safer overcrossings.

Detours

Four miles of this nine-mile freeway construction were hidden from the view of the passing motorist and even a casual glance would not have made him aware of the size and impact of this $13,500,000 undertaking. Only at the ends of the project and at Hatch Road could he have got an idea and some visible hint of his coming liberation from the traffic snarls through this area. One of the most challenging construction problems encountered in the face of complicated traffic movements was to provide smooth passage of traffic through the ends of the projects and at Hatch Road. Eight separate detour plans had to be developed over the entire length of the projects

Freeway traffic over North Street goes unnoticed by the children playing on the cannon in a Ceres park.

The freeway now carries with ease twice the volume of traffic which formerly bogged down by congestion on Modesta's Ninth Street.



The nine-mile, $13,500,000 Modesto Freeway project also extends through Ceres on Highway 99. It culminates more than 14 years of studies and planning and three years of construction.

Motorists no longer have to slow to a crawl through downtown Modesto on old Highway 99 which they once did as shown in this photo.

High speed detours were well posted and the double-blocked-out median barrier protected motorists against oncoming traffic.

to insure that the passing motorist was traveling in the proper highway lane at the right time.

Magnitude

Because of budgetary and staging problems, the freeway construction was handled under four separate projects. The initial $1,200,000 contract eliminated all at-grade intersections by the construction of frontage roads from south of Hatch Road to Whitmore Avenue and an interchange at Hatch Road.

The second project was a grading and structures contract for the portion within Modesto itself. It entailed placing freeway embankments, constructing approach fills and bridges to elevate the freeway grade over the railroad at the north and south ends of Modesto, and constructing approach fills and parallel bridges over the Tuolumne River. This work began in July 1962 and cost approximately $5,300,000. The third project, the $3,500,000 Ceres Freeway, was started in August 1963. Its completion time was carefully calculated to coincide with the completion of the fourth contract, the final stage of the Modesto project. This final stage consisted of a base and surfacing contract for the Modesto portion of the freeway. Work bgean in May 1964 and cost approximately $3,500,000.

Ten interchanges were involved in the design and construction of this freeway, together with nine grade separation structures and dual bridges over the Tuolumne River. The earth fills for the proposed Highway 132 interchange in the vicinity of Kansas Avenue were constructed; however, this freeway-to-freeway connection will not be completed until the future project on Highway 132 is constructed. The completed freeway consists of six lanes from Mitchell Road in Ceres northward to the future Highway 132 interchange. Four lanes are then provided to Prescott Road.

Continuity of Development

On the basis of traffic studies and coordinated planning, the freeway was located "close-in" to Modesto and Ceres. As a result commuters are now able to reach work easily and safely and will have a wide choice of places

Old Highway 99 (Ninth Street in Modesta) was resurfaced by the state prior to relinquishing a portion to the city to became a part of the downtown commercial care.

to live. Businesses and factories will be able to use the freeway for fast and convenient transportation of agriculture and manufactured products.

In Modesto, the freeway parallels 5th and 6th Streets, the north-south local city streets. Traffic is collected onto 5th and 6th Streets from the freeway ramps and local areas, then diffused through the urban developments by local city streets, which are fed off "H" and "I" Streets, the main arteries.

Landscaping Plans

In keeping with the appearance of much of the area, with its tree-lined streets, shaded lawns and parks, a future landscaping project will provide green slopes and make the freeway an eye-appealing project.

As a prelude to things to come, 42 olive trees and six palm trees were recently salvaged from Highway 99 in Salida and transplanted on the Modesto Freeway.

Growing Pains

This Modesto-Ceres Freeway construction is another highlight of progress to keep pace with the population of the area, which is growing at twice the rate of the state as a whole. The completed freeway is but a step in the continuing effort to perpetuate the local community motto appearing on the illuminated metal arch at the entrance to Modesto on the old highway "Modesto—Water, Wealth, Contentment and Health."

Highway 99 traffic through Modesto naw uses this nan-stop, six-lane freeway ending the long, slaw signal-punctuated trip alang Ninth Street.

Rio Vista Street Job

By RAYMOND F. BARTH, Director of Public Works, City of Rio Vista

The City of Rio Vista, in Solano County, recently gave its Main Street, from Front Street to Fifth Street, a new look by complete reconstruction under a contract with Asta Construction Company of Rio Vista.

The $62,000 project, which meets the requirements of the Collier-Unruh Local Transportation Development Act, was financed with gas tax funds.

Four Travel Lanes

The new street is 64 feet between curb faces, has 8-foot sidewalks and is contained in an 80-foot right-of-way. Pavement markings provide for four 12-foot travel lanes and two 8-foot lanes for parallel parking.

Formerly, two of the four blocks reconstructed were 50 feet wide between curbs while the other two blocks were 60 feet wide between curbs. Before Main Street was widened, diagonal parking was permitted.

Sidewalks Replaced

In addition to the construction of new curb and gutter and pavement, it was necessary to replace all of the sidewalk areas because of either the widening or grade changes.

Reconstruction of the street afforded the city an opportunity to replace an ancient 4-inch water main with a new 12-inch line as well as to place the wire for energizing the street lighting circuits underground.

Design was handled by the Vallejo firm of Edward P. Schwafel—Engineer, Inc. Pavement marking was performed by state forces.

BEFORE: Main Street in Rio Vista prior to widening and reconstruction. The street had two lanes and diagonal parking. (Photo by J. B. Andrew)

AFTER: Main Street in Rio Vista following reconstruction. A wider roadway and parallel parking have given enough space for four lanes of traffic. (Photo by River News-Herald)

An outstanding feature of I-5 is the fully landscaped four-level interchange with Route 395 in Balboa Park.

King's Highway

Royal Facelifting for I-5 in San Diego

By DALLAS DICKSON, Associate Highway Engineer

Ever since a group of dedicated Spanish padres established El Camino Real as their inter-mission thoroughfare, its route has dominated the southern California highway scene.

Call it by its Spanish name, which means "The Royal Road," or by the popular but now inaccurate "101," Interstate Route 5 is easily the most important single route in the southern part of the state. As a prime north-south link between San Francisco, Los Angeles and San Diego, 101 has always been heavily traveled. Under the impetus of the interstate highway program, a massive reconstruction program is afoot in San Diego County, rebuilding old 101 from its beginning at San Ysidro on the Mexican border to the Orange County line near San Clemente.

Let's take an imaginary tour on I-5 as it traverses San Diego County, and see what is being done to bring this important route to interstate highway stature. The key map (see page 13) will help orient you as we leave San Ysidro and head north.

Built in 1950's

From San Ysidro to National City we are on a four-lane freeway built in the early 1950's. This, and the similar sections through Oceanside are the only parts of I-5 not yet budgeted for construction to full interstate standards. This southernmost section of the freeway is scheduled to be converted to such standards in another few years.

At National City we enter a recently completed section of the San Diego Freeway, popularly known as the "Crosstown," and find that we can now travel the entire breadth of the central business district on eight lanes of concrete-paved freeway.

This eight-mile section has probably done more to speed travel and promote safety than any other highway project in San Diego. A time savings of at least six minutes has been achieved on an average trip in this area. It is estimated that through traffic saves as much as 15 minutes travel time. In addition, the normal reduction in accident rates experienced in freeway driving is a key benefit.

Fully Landscaped Interchange

An outstanding feature of this route is the fully landscaped four-level interchange with Route 395 in Balboa Park.

North of the "four-level" the new freeway connects to old US 101 via newly completed twin viaducts. The area under these structures provides parking for employees of the nearby aerospace industries. The opening of this connection earlier this year eliminated two traffic signal installations, with a further increase in time saved.

The freeway construction now is being pushed northward toward the proposed interchange with I-8, the major east-west route in San Diego County. The 2.5-mile section currently being built north of the twin viaducts features another viaduct three-tenths of a mile long, which will bypass what is locally known as the "world's longest traffic signal." This multiphase signal at Rosecrans and I-5

will soon be the last full traffic signal system on I-5 in San Diego County, and its elimination will speed local and through traffic noticeably.

Most Complex Section

Probably the most ambitious and complex section of I-5 will be the interchange with Interstate Route 8. This interchange was constructed in model form by the Bridge Department, both for design study and public information purposes. In addition, construction personnel find such a model is a real help in building a project as complex as this. This interchange will also connect to new Route 109, providing a high degree of service to San Diego's rapidly expanding beach resort areas.

Although construction on this interchange will not begin until 1966, there will be a contract let this year for bids opened September 15 for a short section of freeway north of the interchange proper. This project will help traffic during construction of the main interchange and will eliminate two narrow existing bridges. Between this area and Balboa Avenue several budgeted projects are in the works, but construction will not be completed to convert the existing four-lane freeway to eight-lane interstate standards until 1969.

Five Contracts Underway

The area between Balboa Avenue in San Diego and the existing freeway in Carlsbad is the scene of the most intense construction activity in the area at present. From Balboa Avenue to the north there are currently five contracts underway, all of which will provide for eight-lane concrete pavement, designed to Interstate standards.

A contract underway in Rose Canyon north of Balboa Avenue in San Diego provides a connection to La Jolla via Ardath Road, a major street facility recently completed by the City of San Diego. Motorists traveling between downtown San Diego and La Jolla will notice a significant time savings when the new connection is completed. In addition, one five-mile section was recently opened to traffic near Del Mar and another project is advertised. Although the completed portion is "open-ended," connecting thus far only to county roads, there is a surprising amount of traffic using this facility.

To link this section with the old freeway in Carlsbad, two projects are scheduled for completion by 1966. The four contracts to the south will also be completed by then. The timing of the whole series of contracts from Balboa Avenue to Carlsbad is most critical, in that they must all be completed before traffic can be diverted from the existing highway at the south end.

This traffic switch is currently scheduled for the summer of 1966, hopefully in time to help out during the late summer traffic peaks which

Newly completed twin viaducts connect the freeway with US 101 north of the four-level interchange.

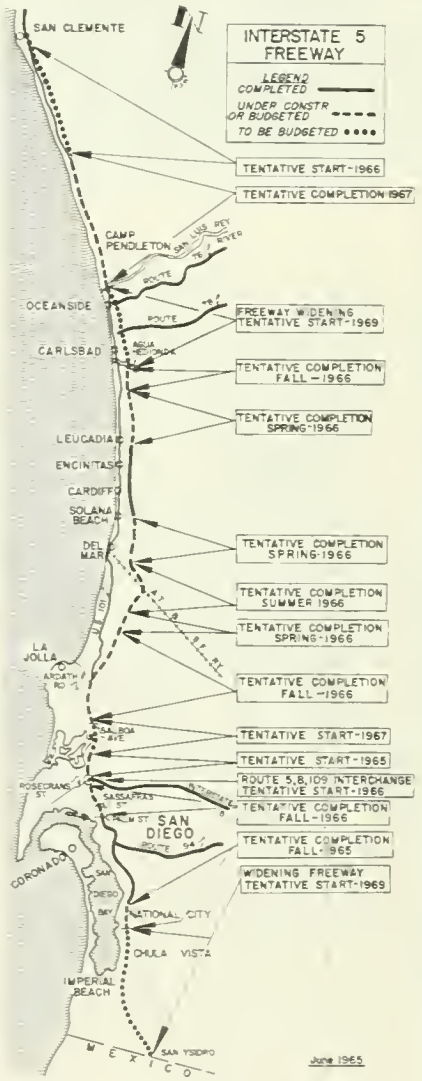
A section of the new freeway just prior to its being opened to traffic.

occur coincidentally with the racing season at the Del Mar Turf Club.

1966 Completion

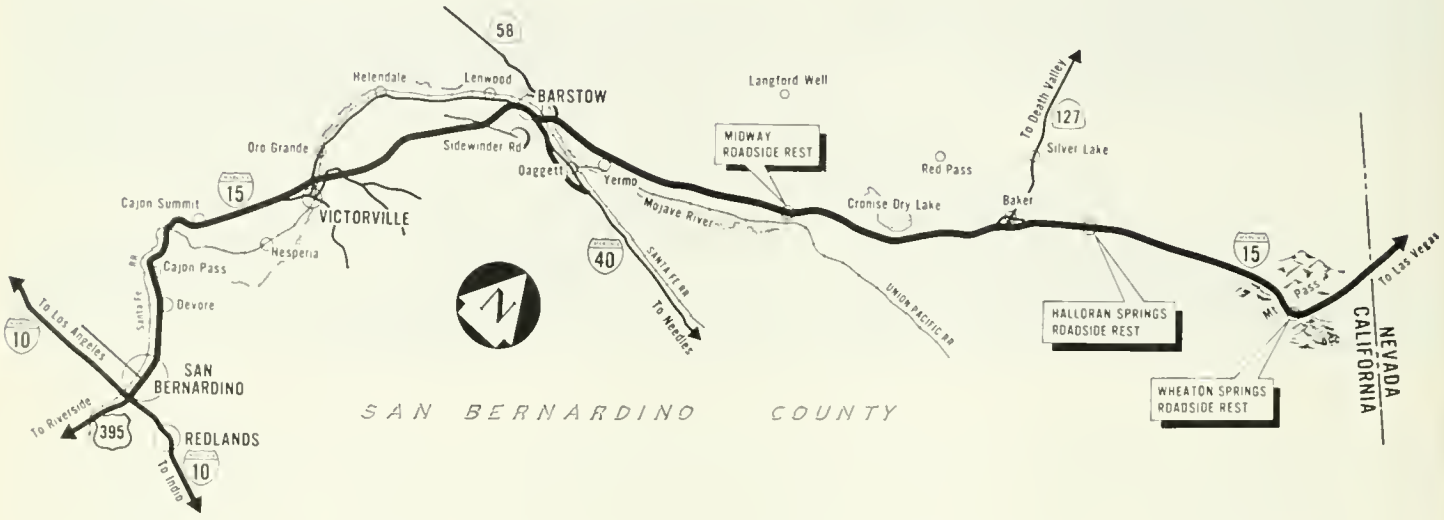
Thus we see that by the middle of 1966 I-5 should be completed to freeway standards all the way from the Mexican border to just north of Oceanside. From Oceanside to San Clemente the existing highway is four lanes, with a narrow median. To combat an increasing accident rate, we have just completed the installation of median barriers on the northern part of this area. The hope is that this will minimize the accident picture until the road can be completed to freeway standards. Work on the modernization of this stretch of old 101 should begin, and be open to traffic sometime in 1967. With its completion the motorist leaving San Diego will have smooth sailing on I-5 throughout the county.

For design study and public information purposes, the Bridge Department constructed the Interstate 5 and 8 interchange in model form.



Status of planning and construction on I-5 between San Ysidro and San Clemente is shown on the above map.

California's Interstate 15:



186 Miles of Divided Highway Across the Desert

By TAYLOR SMITH, Associate Highway Engineer

Completion of an 18-mile freeway section near Baker this fall brings California's 186-mile portion of Interstate Route 15 to expressway and freeway standards for its entire length.

Two-thirds of the mileage in the Golden State is complete to Interstate standards. The route begins at a junction with Interstate 10 in San Bernardino; continuing easterly, it enters Nevada 15 miles beyond Mountain Pass.

Only two sections of expressway remain—a 52-mile stretch from Devore Road north of San Bernardino to Sidewinder Road south of Barstow will be upgraded in the future, as will a 15-mile segment in Cajon Pass. The latter is slated for realignment and widening, with construction of four overcrossings between Victorville and Barstow.

History

Historically, Interstate Highway 15 between San Bernardino and Barstow is a part of the National Old Trails Highway which was incorporated into the state highway system by legislative act in 1909. From Barstow to the Nevada state line, it is a part of the Mormon Trail, which later became the Arrowhead Trail, and was added to the state highway system by legislative act in May, 1925.

When taken into the state highway system, the road consisted of a macadam-surfaced county road through Cajon Pass. It reached Victorville by way of Coyote Canyon and Hesperia.

From Victorville to Barstow the road was mainly a joining of local ranch roads which followed the Mojave River through Helendale. The oiled surface ended near Cajon Summit and the remainder of the route was either rocky or sandy and never smooth.

Eorly Routes

To reach Las Vegas and Salt Lake City from Barstow, the adventurous early-day motorist had a choice of two routes.

The first was to swing north from the National Old Trails Highway at Daggett and follow the Arrowhead Trail northerly of the present highway through Red Pass, Silver Lake and Goodspring, Nevada.

The second and preferred route, even though of longer distance, continued east on the National Old Trails Highway through Ludlow and Amboy to Klinefelter. At Klinefelter, a trail turned north through Searchlight to Las Vegas. This route was preferred because it was more heavily traveled. It roughly paralleled the Santa Fe Railway from which help could be obtained in emergencies, as railroad crews would aid stranded motorists.

Even though San Bernardino County, in 1924, pushed through a new alignment of the Arrowhead Trail from Yermo easterly by following the Union Pacific Railway for some 20 miles and then on diagonally northwest through Baker and Silver Lake, most people still preferred the longer route over the National Old Trails Highway through Klinefelter and Searchlight.

E. Q. Sullivan, retired district engineer, reported that in 1924 his first

inspection trip over the county road required 18 hours of driving to reach Las Vegas from Barstow and that not another car was met or passed for the entire distance.

Construction

Construction in the period of 1922 to 1927 consisted of building a 21- to 24-foot unsurfaced roadway for approximately 105 miles from Cajon Summit to Cronese Valley east of Barstow.

Hesperia became the first community to be bypassed when realignment was made directly from Cajon Summit to Victorville and the road surfaced in 1922. In 1930, an oil dust palliative was placed on the road from Cronese Valley to the Nevada state line. This oiled surface is still traversable today on many of the sections of the old Arrowhead Trail abandoned in the early 1930's because of realignment.

Realignment

In the early 1930's major realignment was made in Cajon Pass and new alignment provided directly to Yermo from Barstow. Construction during this period provided a so-called "60-mile-per-hour" highway of two 10-foot surfaced driving lanes and unsurfaced shoulders. Realignment continued until 1937 when the final section was completed between Mountain Pass and the Nevada state line.

Aerial panorama of the Hallarbn Springs Raadside Rest areas. View is westerly dawn Baker Grade taward Soda Dry Lake.

The junction of Interstate 15 and Interstate 40 spreads like a "Y" neor the east city limits of Barstaw, encompassing residential sections that have developed since canstruction af the freeway.

During the major construction in the early thirties, horizontal alignment was greatly improved and asphalt-covered, timber-decked bridges supported on timber piles were constructed over the major stream channels. The narrow 24.5-foot width of these structures contributed to the accident record as traffic increased each year. Shortly after World War II, the bridges were redecked and widened to 26 feet.

All of the structures on the route were reaching structural inadequacy after 30 years service at the time they were replaced with portland cement concrete units when separate roadbeds were constructed.

After the War

Little improvement other than routine maintenance was undertaken on the route until after World War II,

Parkinsonia trees have been planted in the median and along roadway slopes between Victorville and Barstow to enhance the appearance of the freeway. These trees require no watering.

Easterly view of the Baker Grade. In the distance is Hallaran Summit.

PICTURES OF THE NEW

All vehicles entering the state on Interstate 15 are required to stop for an agricultural inspection at this station near Yerma.

Roadside rest area at Hallaran Springs provides shaded picnic tables, water, and rest facilities for motorists.

Native shrubs and trees were not disturbed by construction. From this point near Hallaran Summit, the roadway is visible for 13 miles as it dips down to Valley Wells and rises toward Clark Mountain.

Division of Highways' maintenance crew used two Fordson tractors to tow a grader in 1924. The Dodge at left is in "step" with those times.

An early view of an improved section of the Arrowhead Trail after the ruts had been dragged smooth and tire-puncturing rocks removed. Speeds of 35 miles per hour could be attained.

Construction near Cajon Summit in 1930, when the winding old road at the left was replaced on new alignment. A crew of laborers is finishing excavation slopes.

CONTRAST WITH THE OLD

A view of the unsurfaced Arrowhead Trail west of Cranese Dry Lake in 1927. Rocks, removed from the traveled roadway as tire hazards, are visible at left.

Much of the roadway excavation during early construction was accomplished with mule-drawn fresnoes.

when in the early 1950's (as an interim measure) most of the road was resurfaced, the width of traveled way increased, and surfaced shoulders added.

Conversion to expressway and freeway was undertaken in 1953 in Cajon Pass and was completed over the summit to Victorville in 1956. Relocation around Victorville was completed in 1957. Oro Grande and Helendale were bypassed in 1958, when major realignment shifted the highway easterly to a more direct route from Victorville to Barstow and cut 4.7 miles from the distance between the two cities.

The highway was relocated southerly around Barstow in 1962 and northerly around Yermo in 1963. Baker became the last community to be bypassed with the completion of construction in 1965.

Future Plans

Future plans for this route include a realignment from Devore Road to Cajon Summit which will decrease the road's length by 1¼ miles. The result will be an estimated user's savings of $46,000,000 over a 20-year period.

Desert construction on Interstate 15 has been most notable for the length of highway constructed under each contract. The 29-mile project between Victorville and Barstow is the longest expressway completed under one contract in the state. Other desert projects have ranged from 18 to 25 miles in length. This route also has the distinction of containing the 1,500th mile of freeway to be completed in California.

Construction methods and techniques have shown remarkable improvement since the first roads were completed with mule-drawn fresnoes. Early-day tractors gradually replaced mules as power for towed graders which in turn were replaced by motor graders for placing the "desert mix" of the early 1930's.

New maintenance stations have been constructed at Victorville, Barstow, Baker and Mountain Pass and existing stations utilized at Cajon and San Bernardino. Modern living quarters are provided at the stations at Baker and Mountain Pass as an inducement for workmen to live in such remote areas where living quarters would not otherwise be available.

The original Arrowhead Trail followed a route between springs and wells so that the average distance from one source of water to another was usually about 20 miles.

Water is still important for the present-day motorist, as many cars tend to overheat on long desert grades during the summer high temperatures. To assist the traveling public, safety rest areas have been constructed at Midway, Halloran Springs, and Wheaton Springs with water available at all three locations. Rest rooms and picnic ramadas were added at Halloran Springs and Wheaton Springs during the summer of 1965 and similar facilities will soon be added at Midway.

Future plans provide for additional roadside rests at Cozy Dell in Cajon Pass and at Sidewinder Road south of Barstow.

To provide erosion protection and to act as a screen between opposing streams of traffic, every effort was made not to disturb native shrubs and bushes. Experience has shown that many years are required for native growth to reappear after it has been disturbed.

To enhance the appearance of the freeway and relieve the desolate appearance, Parkinsonia trees have been planted in the median and along the roadway slopes between Victorville and Barstow. A tree-planting project is also planned on the Baker grade.

Traffic

Traffic volumes have increased steadily over the years. The average daily traffic has increased from fewer than 100 vehicles per day in 1926 to 6,500 vehicles per day in 1964 passing the California-Nevada state line at Mountain Pass. The highest volumes occur on weekends, when daily traffic has reached 10,000 vehicles.

SPOT CORRECTIONS INTENSIFIED

Before this section of Route 70-99 in Sutter County at right was widened and a left-turn lane installed last spring, motorists waiting to turn left were endangered by traffic rounding the bend behind them. This location had been the site of 19 accidents in the period 1961–64—most of which were "rear enders." The Division of Highways has intensified its efforts to identify and correct such points of accident concentration that can be improved by traffic engineering, in line with increased national emphasis on traffic safety.

Spot corrections are now established as a specially financed category in the annual state highway budget.

Shields Avenue

Fresno Widens Street to Four-lane, Divided Arterial

By DONALD M. WINTON, Assistant City Engineer, City of Fresno

The City of Fresno, like many cities in California, has been trapped for many years with insurmountable street deficiencies, while handicapped with a skyrocketing tax structure inadequate to meet these deficiencies.

The Collier-Unruh Local Transportation Development Act which increased the state gas tax one cent in 1963 along with other highway user tax increases has given Fresno and other cities, and counties, a shot in the arm by providing more money to chip away at our many street needs at a faster pace, bringing our street deficiencies down to a tolerable level.

A good example in the City of Fresno is the recent widening of one mile of Shields Avenue from Palm to Glenn Avenues. The old road was predominantly 36 feet between curbs in 60 feet of right-of-way. Development is light commercial and residential. The 1965 ADT (average daily traffic) being 12,000 cars was causing serious congestion problems. By 1985, traffic would increase to 18,000 cars a day. As a result, this project was number one on the city's priority list.

Shields Avenue in the City of Fresno after its widening to a four-lane, divided roadway.

Four-lane Divided Arterial

The new construction is a four-lane divided arterial with parking provided. The new right-of-way is 100 feet. The limited landscaping, paid for by city funds, has encouraged property owners to make similar improvements. The result is an efficient and attractive street.

Financing for this project began in 1963–64, when the City of Fresno budgeted $295,000 for right-of-way acquisition. This amount represents the city's entire gas tax revenue available for new construction for that year. At this rate the city would have required two years to budget sufficient funds, using only the ⅜-cent gas tax revenues, as the project had R/W costs amounting to $355,000 and construction costs amounting to $180,000.

Because the new 1-cent gas tax revenue provided the City of Fresno with an additional $330,000 annually, the city was able to construct this project and another smaller project, one year earlier. Future projects costing approximately $600,000 or less will require only one year of financing because of this new money.

Full Effect Not Yet Felt

The full effect of the new legislation, however, has not as yet been entirely felt by all cities and counties in the State of California because of provisions requiring matching credits to qualify for the new 1-cent gas tax revenues. To date most organizations have been able to keep pace using past expenditures and subdivider expenditures as their matching money. This backlog will be exhausted soon and governmental units will have to use general funds to equal the revenue from the one cent gas tax.

In the case of the City of Fresno, matching credits must be provided in the approximate amount of $330,000 annually. Considering the estimate of $130,000 to come from subdividers, Fresno's general fund will then be required to expend an additional $200,000 per year for our matching share.

The anticipated availability of $850,000 per year for R/W and construction costs in the near future, as compared to approximately $300,000 per year that has been available in the past, will enable the City of Fresno to triple its street improvement program. Thus, with the aid of the Collier-Unruh Act, the City of Fresno is pressing towards the goal of providing its citizens effective relief from staggering street deficiencies. The motorists throughout California will soon be enjoying greatly needed road and street improvements, saving them millions of dollars in time delay and decreased accident experiences.

The Ridge Route

Construction History, Future Plans Summarized

By HEINZ HECKEROTH, Senior Design Engineer and
BARRY COHON, Assistant Information Officer

"I didn't get into town very often then, but my husband used to go in regularly either to Los Angeles or Bakersfield — at least twice a year," said Mrs. Mary Ralphs of Gorman as she recalled pioneer life in the northern sector of Los Angeles County some 60 years ago.

Bakersfield was a day-and-a-half trip north from their ranch by horse and buggy, and Los Angeles was two-and-a-half days south, necessitating stopovers at Elizabeth Lake and Newhall. Now, Bakersfield is 45 minutes away, and Los Angeles just over one hour via Interstate 5—and that time will soon be cut even further by new

An unidentified highway engineer pauses at Ralphs' ranch house at Gorman Station in this 1913 view. The house, originally a one-story log cabin later covered with siding and enlarged, immediately adjoined the first Ridge Route. Later, the house was destroyed to make room for the 1933 realigned highway.

Looking south through the Big Cut on the first Ridge Route highway. The time: 1915.

ork on the Ridge Route portion of
lifornia's "backbone" road.

In the early days, Gorman was a
ge stop near the summit of the
ng and tortuous north-south route
rough lonely ranch country. Later,
cept for occasional gypsy caravans,
ary Ralphs recalls not seeing a hu-
an being outside her immediate
mily for many weeks at a time. She
ised eight children, all of whom re-
ain within a few miles of the old
orman ranch. Fit and smiling at 83,
ary Ralphs today is the grand-
other of a family that plans to add
60-unit, two-story motel to the
staurant and other enterprises they
w operate in the area.

Ridge Route History

The story of the Gorman ranch is
d to the history of the Ridge Route.
he state highway, when opened to
tomobile traffic in 1914, went right
st the Ralphs ranchhouse. The fam-
was twice relocated when the route
as realigned in the '30's and '40's.

Livestock is still the primary prod-
t of the area, but land development
increasing rapidly, spurred by the
rthward expansion of Los Angeles'
etropolitan complex. In the Castaic-
n Francisquito Canyon vicinity,
out 30 miles south of Gorman, $24-
0-and-up homes are frequently pur-
ased before they are even built in
and new tracts. A state college is
anned for the area.

Accelerating the development along
e Ridge Route are public works
ojects by the State Department of
ater Resources and the Division of
ighways. As in the case of the West-
le Freeway through the San Joaquin
alley, the State Water Project's Cali-
rnia Aqueduct parallels and crosses
e freeway. Two State Water Proj-
t reservoirs will be built in the
dge Route area to help bolster
uthern California's water supply.
ey will also attract a large volume
recreation traffic to their shores.
staic Reservoir terminal facility of
e West Branch of the California
queduct and Pyramid Reservoir will
en skirt Interstate 5. A huge tunnel
ill connect the two reservoirs.

The Gorman schoolhouse in 1913. The people on the porch are not quite identifiable although Mary Ralphs surmises that some are her children—because the white horse named Pluto was their transportation to school.

A Vital Link

Since 1914, the Ridge Route has been a vital link in California's highway network. The "old old" highway, still in limited use, wound through the rugged mountains for over 48 miles and included so many curves that a driver had to make more than 100 complete circles. In the '20's it was still considered an example of bold engineering but it proved inadequate to carry the traffic load of a rapidly growing region.

This growth was directly reflected in heavier motor vehicle traffic of all types, particularly along this key transportation link between the increased agricultural and petroleum production of the San Joaquin Valley and the expanding industrial, commercial and population development south of the Tehachapis.

In 1933 a new, wider, and more direct route (the Ridge Route Alter-

Four-horse Fresno scrapers gnaw their way through the mountains for the original Ridge Route in this photo taken June 24, 1915.

A vertical aerial of the Tejon Summit area shows the present highway and a section of the proposed realignment. Line with circles shows location of the San Andreas Fault through this area.

nate) through Piru Gorge cut 10 miles off the trip between Castaic and Lebec. But increasing traffic, particularly heavy trucks, soon began to strain the capacity of this three-lane highway. In 1940, improvement studies were started but construction had to be postponed until after World War II. From 1947 to 1952 the route was widened and modernized to a four-lane expressway. By 1969 it will be an eight-lane freeway with gentle curves and an improved profile.

Planning

Planning and design studies for converting the Ridge Route to full freeway have been underway since 1955. In 1957–1958 the original freeway concepts for the route from the north city limits of Los Angeles to the Kern County line were formalized. Numerous supplemental reports prepared since that time have modified the original concept of six-lane initial construction and eight-lane ultimate construction. The design and construction now underway features an eight-lane Interstate freeway for the entire 45 miles at an estimated construction cost of 90 million dollars, with a design speed of 70 miles per hour using 3000-foot radius curves and 4.5 percent maximum desirable grade on new construction.

The freeway construction utilizes various sections of the old four-lane expressway in several ways:

1. Converting the existing expressway to full freeway with a widened right-of-way;

2. Using the existing expressway as part of an adjacent and paralleling frontage road system which will revert to local control;

3. Using some existing expressway as an access road to the Piru Creek headquarters;

4. Converting existing expressway to a one-directional freeway roadway which would be coupled with a widely separated, newly constructed freeway roadway to carry traffic in the other direction. At one location, in the vicinity of the Five-mile Grade north of Castaic, the roadways are "reversed"—the new southbound roadway will be east of the existing expressway, which will carry northbound traffic—for reasons of safety and economy.

The terrain traversed by the freeway varies from the relatively low and flat Santa Clara River–Castaic Creek Valley at an elevation of 1,200 feet to the relatively high and gently sloping Gorman Creek Valley at an elevation of 3,500 feet; from the Weldon-Gavin Canyon Summit at an elevation of 1,800 feet, just north of the Los Angeles city limits to the Holland or, more properly, Tejon Summit at an elevation of 4,200 feet, near the Kern county line. It includes 14 miles through rugged mountain terrain where the average elevation is 2,800 feet.

Land Use

Land use has been agricultural—predominantly grazing in the Gorman area—with some truck farming in the Newhall-Saugus-Castaic area. The 14 miles in Angeles National Forest is covered with dense low native growth and is expected to remain in its natural state under administration of the United States Forest Service. The Gorman area probably will continue to be predominantly agricultural for

A map showing the new freeway interchange and separations between Saugus Junction and Castaic at the south end of the Ridge Route.

number of years and therefore motorist service developments will be centered around interchanges.

Conversely, the Newhall-Saugus-Castaic area might well explode with mushrooming urbanization, a future spill-over from Los Angeles' San Fernando Valley. Indicative is a population of 4,000 in 1955, 17,000 today, and 115,000 predicted in 1985. Subdivision grading now underway, recent completion of a golf course near Saugus Junction, the number of tentative tract maps filed with Los Angeles County, and development studies started, are all barometers of this expected growth.

The recreational potential along the route will be greatly enhanced by the construction by 1971 of the Castaic Reservoir, the terminal reservoir of the West Branch of the California Aqueduct of the State Water Project. Included in the land acquisition program for the reservoir is acreage to be improved to serve the recreational needs of an estimated 12,000 people per day. The lake formed behind the 330-foot high earthfill dam will cover an area of 2,600 surface acres, store 150,000 acre-feet of water and provide 14 miles of shoreline.

The second State Water Project reservoir will be built in the Pyramid Lock area of Piru Creek. The Pyramid Reservoir lies entirely within Angeles National Forest in a rugged canyon. Its anticipated completion year is 1973.

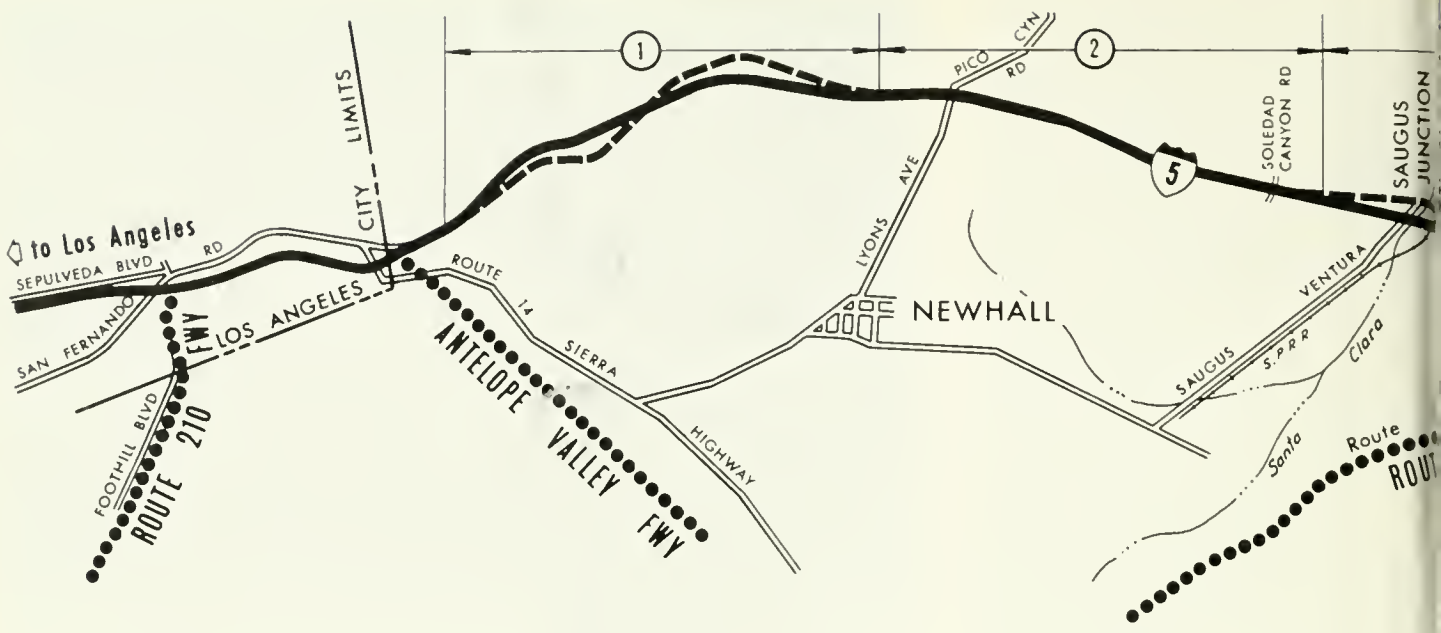
Traffic Forecasts

Traffic forecasts reflect the anticipated urban growth of California and the recreation potential of this area. Within 20 years, traffic on Interstate 5 is expected to increase 400 percent. (See table) Trucks will comprise nearly 20 percent of the Average Daily Traffic and about 5 percent of the peak hour traffic. At present, they comprise about 15 percent of the traffic, with the bulk of this percentage made up of big rigs—four-axle or more.

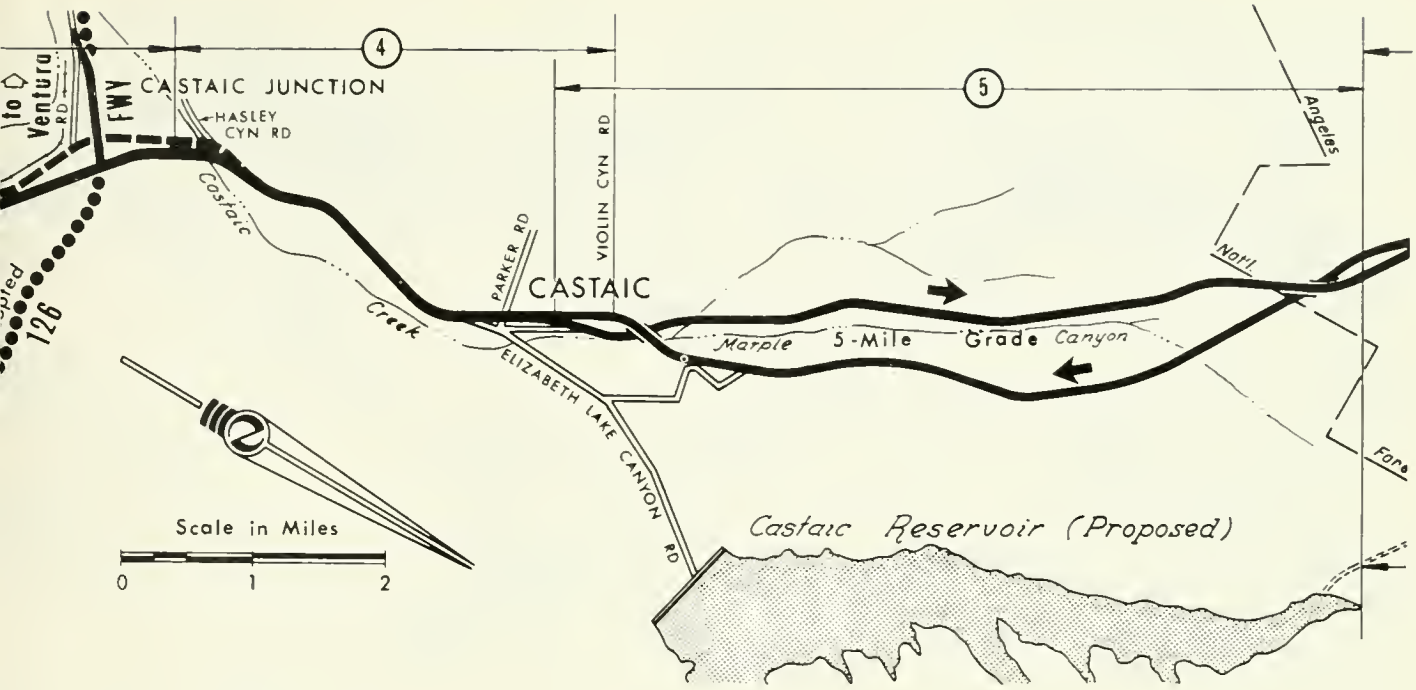
The area traversed by this portion of Interstate 5 furnishes a major traffic corridor as well as a major utility

Looking west along the Route 126 Freeway from its interchange with the Ridge Route (foreground). The frontage road undercrossing is in the center. (See map previous page)

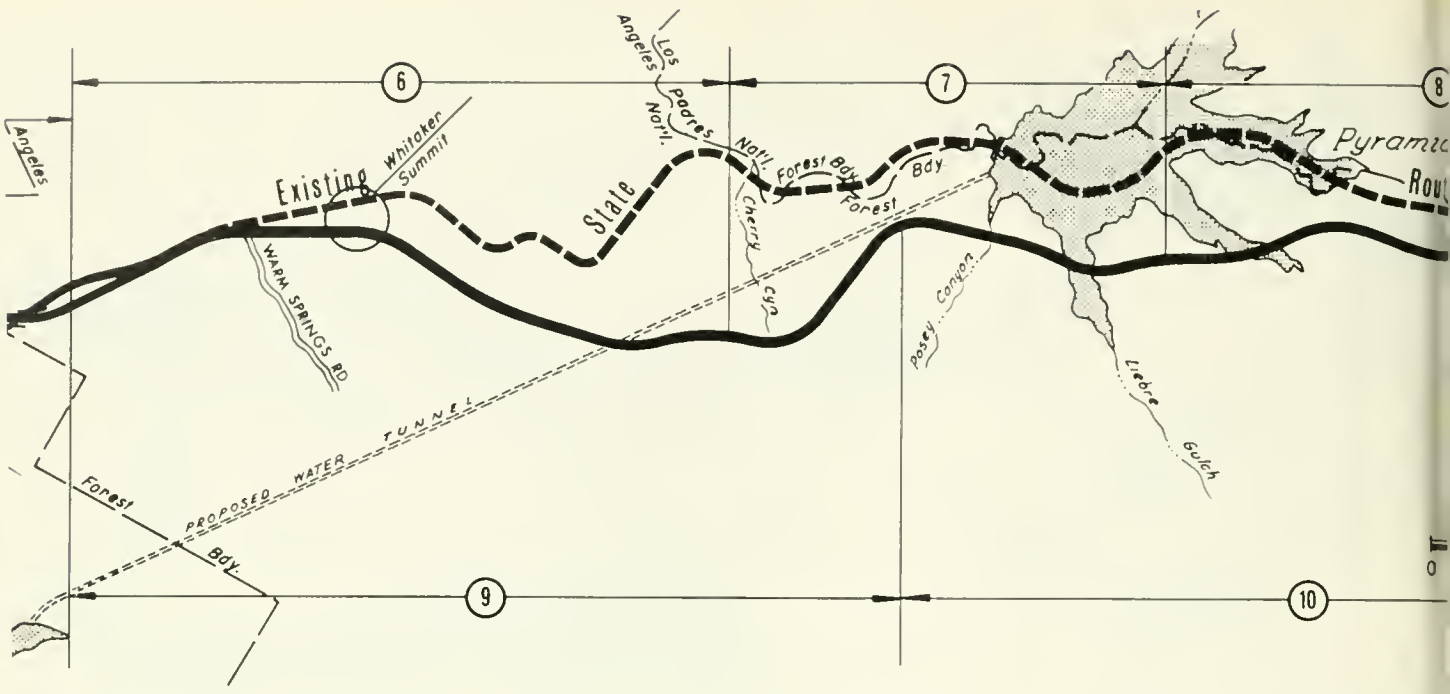
The new California Highway Patrol truck scales went into operation last January near the Interstate 5-Route 126 interchange. (See map previous page)



	1	2
LIMITS:	1.1 miles to 4.1 miles north of Route 14	4.1 miles north of Route 14 to 1 mile south of Santa Clara River
LENGTH:	3 miles	3½ miles
TERRAIN:	Canyon	Hilly farm land
INTERCHANGES:	None, 3 bridges	Two now: Pico-Lyons Ave. and Soledad Canyon Road; One future: McBean Parkway
BUDGET AMOUNT AND FISCAL YEAR:	$7,500,000 1965–66	$3,500,000 1965–66
DESIGN CHARACTERISTICS:	70-m.p.h. 8-lane freeway 4.6% max. grade, 3000′ minimum radius curves, separate roadways using a 60′ median. Extensive modification of Gavin Canyon drainage system includes several major transverse and longitudinal culvert and open channel installations and numerous minor culvert crossings. Major roadside rest includes parking for 20 cars and 4 trucks plus picnic and comfort facilities.	Alignment and profile based on 70-m.p.h. standards using separate grade line with 60′ median. Stage construction for minimum traffic interruption. Portions of existing expressway roadway near Pico-Lyons will be frontage road. Major contract items include 1,000,000 cubic yards of roadway excavation. Drainage uses cross culverts to perpetuate natural drainage pattern.
STATUS:	Under construction	Under construction
TARGET DATE:	Mid-1967	Mid-1967
PROJECT ENGINEER:	Bob Allen	Bob Allen
CONSTRUCTION ENGINEER:	Mike Sturgeon	

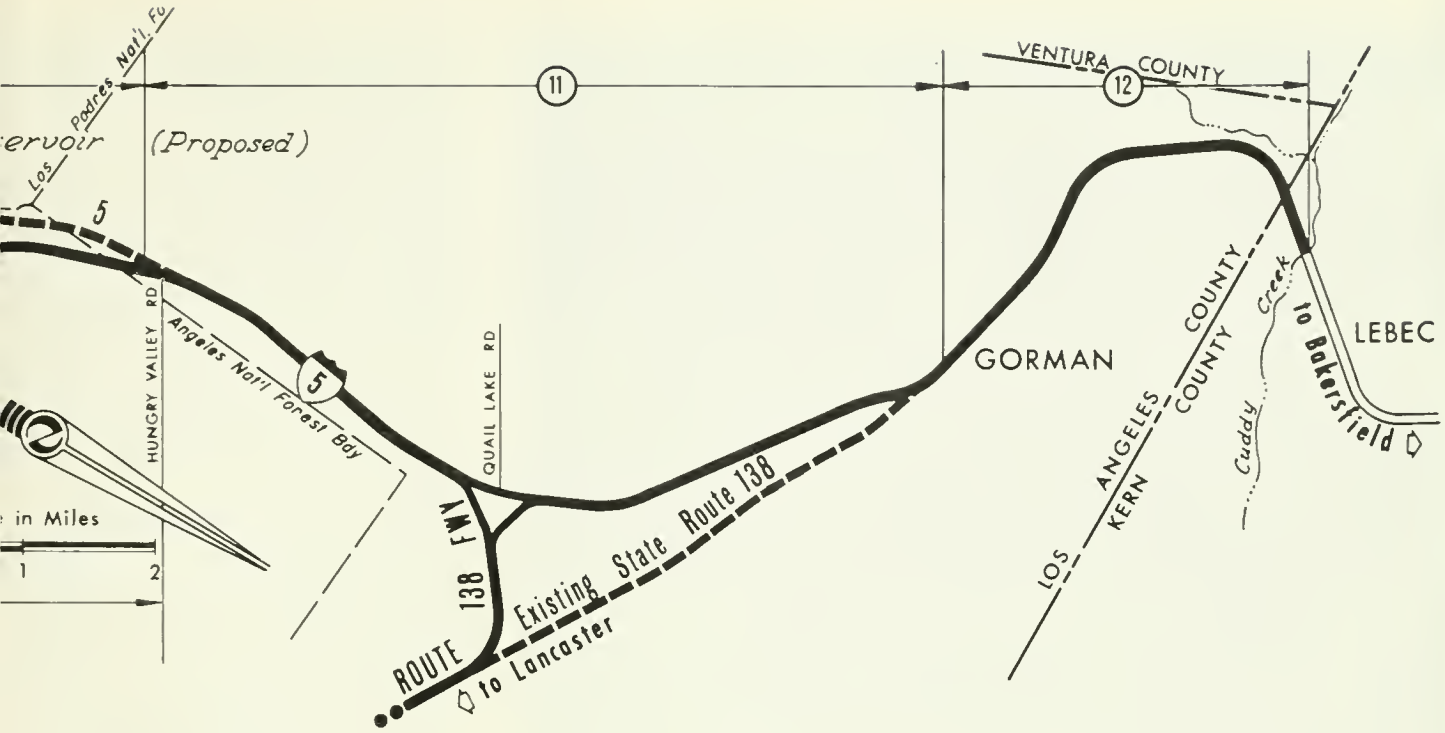


3	4	5
0.8 mi. so. of Saugus Jct. to 3.1 mi. so. of Castaic	0.4 mi. so. of Castaic Creek Bridge to 1 mi. no. of Parker Road.	0.4 miles to 6.8 miles north of Parker Rd., Castaic
3.3 miles	4 miles	6.4 miles, including the famous 5-mile grade
Rolling hills	Flat river plains	Mountainous
Interchange at Saugus Jct. and Castaic Jct., plus initial phase of interchange between Route 5 and 126. Also structures over S.P.R.R. and Santa Clara River	Hasley Canyon Road, Parker Road, and Violin Canyon Road.	None
$5,600,000	$5,000,000 1966–67	$12,000,000 1965–66
Old 4-lane expressway resurfaced and relinquished to L. A. County. Major weigh station and brake inspection station for northbound trucks.	Conversion of present 4-lane expressway to full freeway, using 70-m.p.h. design standards, 3000′ minimum radius and 36′ median.	Existing roadway in 5-mile grade to be reconstructed on existing alignment to serve northbound traffic. New roadway to be constructed on east side of Marple Canyon for southbound traffic. This will produce an "English style" road with up to a 2000′ median.
Completed. Opened to traffic Dec. 22, 1964	Design nearing completion	Late design stage
	Spring 1968	End of 1968
Billy Hunter & Ken Hintzman	Ken Hintzman	Vince Ramirez
R. M. Innis		

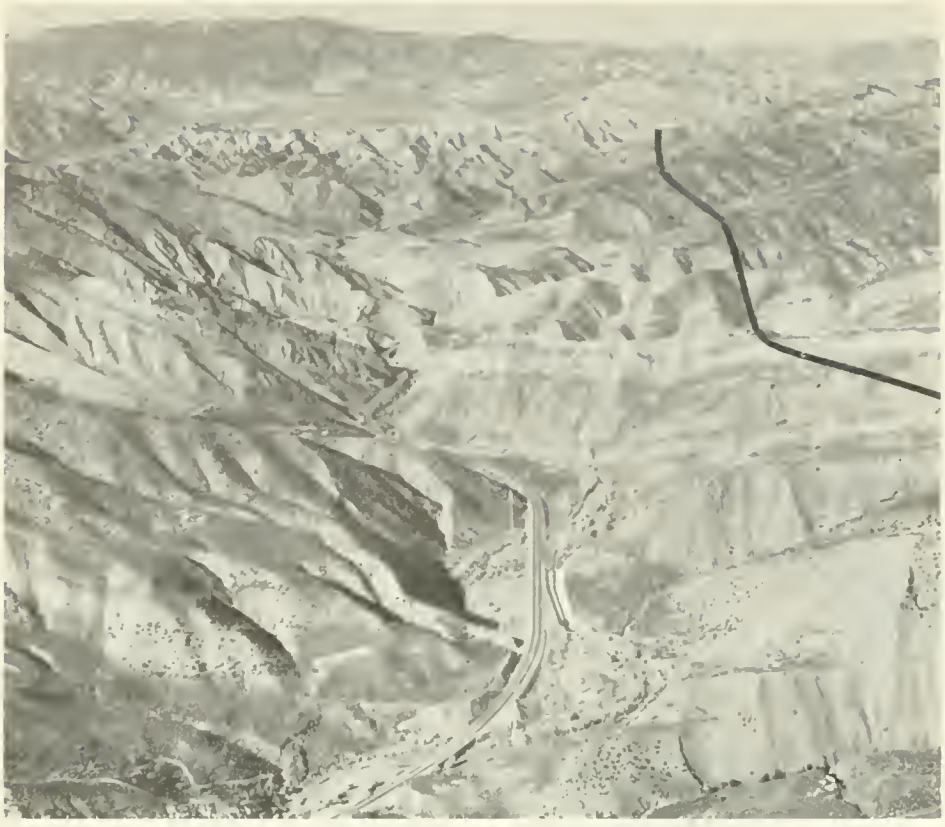


	6	7
LIMITS:	6.9 mi. to 12.3 mi. north of Castaic	12.3 mi. north of Castaic to 10.3 mi. south of Rte. 138
LENGTH:	5.4 miles	3.6 miles
TERRAIN:	Mountainous	Mountainous
INTERCHANGES:	Warm Springs Rd.	None
BUDGET AMOUNT AND FISCAL YEAR:	$7,800,000 in '65–66 $4,600,000 in '66–67	$9,500,000 in '65–66 $6,000,000 in '66–67
DESIGN CHARACTERISTICS:	*1st stage:* grading and substructures for ultimate 8-lane fwy. with minimum 36′ median, split roadway through a portion, minimum 3000′ radius curve. Old roadway will be relinquished to county. Maximum grade: 4.2%	*1st stage:* grading and structures for ultimate 8-lane fwy. with 36′ median and 3000′ radius curves, including large arch culverts of special design at Cherry Canyon, Allen Canyon, Posey Canyon, and Liebre Gulch.
STATUS:	Under constr.	Under constr.
TARGET DATE:		
PROJECT ENGINEER:	Bob Allen	Bob Allen
CONSTRUCTION ENGINEER:	John Byrne	Ken Mock

	9	10
	2nd stage: Paving 6.8 mi. No. to 13.2 mi. no. of Parker Rd., Castaic. $3,500,000 in '67–68	*2nd stage:* Paving, 13.2 mi. of Parker Rd. to 6.7 mi. so. of Route 138, 6.4 miles in length, $3,200,000 in '67–68. Old road to be relinquished to county upon completion of paving of freeway.
	Open in early 1969	Open in early 1969
	Ken Hintzman: Project Engineer.	Ken Hintzman: Project Engineer.



8	11	12
10.3 to 6.8 mi. south of Rte. 138	6.8 mi. so. of existing Rte. 138 to 0.6 mi. no. of same; and Rte. 138 fwy. from Rte. 5 to 2.1 mi. east of 5	0.6 mi. no. of Rte. 138 near Gorman to Cuddy Creek Bridge in Kern County.
3.5 miles	Rte. 5—7.4 miles Rte. 138—2.1 miles	3.8 miles
Rugged mountains with cuts and fills up to 300′	Mountains and high meadow	Top of ridge
None	Hungry Valley Road Rte. 138 and Quail Lake Rd.	3 bridges
$5,400,000 in '65–66 $3,200,000 in '66–67	$9,400,000 1965–66	$5,900,000 1965–66
1st stage: grading and structures for new alignment with 3000′ radius curves and grades not exceeding 3.6%.	8-lane freeway on present alignment; utilizing portions of existing ppc pavement; stage construction will maintain 2 lanes traffic in each direction. Route 138 is 1st leg of Metropolitan bypass. Inside the interchange, 175 acres will be developed for commercial purposes.	8-lane freeway with 22′ median and 2600′ maximum radius curves. Massive detour provisions during construction. San Andreas fault requires lowering grades at summit by 50′.
Under constr.		Under constr.
	Planned to open by end of 1967	Late 1966 opening.
Hank Harvey	Charles Strand	Rolland Marino
John Muhich		Bob Innis



Scenic Piru Gorge showing the existing route and, to the right, the projected new route for Interstate 5.

Looking north from Liebre Gulch along the existing Ridge Route with the projected new route indicated by the broken line (upper right).

route for overhead transmission lines, natural gas lines, and oil lines. Numerous utility relocations along the route are necessary because of the new freeway location.

In Angeles National Forest, utility relocation design solutions and construction activities were subject both to the state's encroachment policies and to the Forest Service Special Use Permit procedures. Utility relocation is a major right-of-way expense, amounting to $4.5 million and involving 60 separate agreements with no less than 10 individual utility companies.

AVERAGE DAILY TRAFFIC ON INTERSTATE 5

In 1964	*Location*	*Predicted for 1985*
24,000	Weldon Canyon Summit	90,000
20,000	Castaic Junction	60,000
15,000	Tejon Summit	60,000

The United States Forest Service cooperated fully in negotiating for freeway right-of-way through the Angeles National Forest. A normal right-of-way width of 800 feet was required, and widths up to one-half mile are necessary to contain the largest cut and fill sections. Concern was expressed by the forest service in regard to fire prevention, erosion control, and aesthetics as pertaining to protection of natural ground cover. Therefore, an extensive fire prevention plan has been included in the planned appropriation for freeway right-of-way. Erosion control measures include obliterating all construction and service roads after construction (unless required for fire protection purposes), extensive seeding and straw placement on new embankment slopes, and massive dissipators at drainage outlets to return the accelerated flow to natural stream velocity.

Location and Design

The planning studies for routing the Interstate 5 Freeway were conducted in two parts: from the north city limits of Los Angeles to Parker Road near the community of Castaic, and from Parker Road to the Kern county line. These studies were preceded by

earlier ones on locations through the mountains and over the Tejon Summit.

Three possible alternate crossings of the summit were chosen in addition to the one now being reconstructed. All crossings were planned with stress on the importance of reducing the old 6 percent grades in order that user costs could be reduced. Originally included was a study of a 9,600-foot-long tunnel with 3-percent maximum grades. The latter proposal was found impractical from an economic standpoint.

The proposal to lower the summit elevation near the existing expressway alignment was discussed at a public hearing in Gorman in June 1961, covering the stretch of highway between 9.5 miles south of Gorman and the Kern county line. The remaining length, to Parker Road, was the subject of two public hearings in Castaic in January 1962 and March 1964. Relocation around the federal power withdrawal areas in Piru Creek was discussed along with the possibility of using the existing expressway for northbound traffic and building a new roadway for southbound traffic to the east, at what is commonly known as the Five-mile Grade, just north of the community of Castaic.

The results of studies between the north city limits of Los Angeles and Parker Road were discussed at a public hearing in Castaic in 1957. The selection was predominantly a reconstruction of the existing expressway, with minor relocations planned between Saugus and Castaic Junctions.

Design

For design purposes the route has been segmented into 12 major projects. (See map and "Ridge Route at a Glance").

These projects include the construction of two major freeway-to-freeway interchanges (between Route 5 and Route 126 near Castaic Junction; and Route 5 and Route 138 south of Gorman), as well as 13 local interchanges.

Alignment and profile standards necessitated numerous large cut and embankment sections with the attendant excavation of 50 million cubic yards of material for the 12-mile relocation through the National Forest.

Roadside Rests

Portions of Interstate 5 Freeway are included in the State Scenic Highway System, and special provisions for travelers are included in the design. On the section between the Route 14 Interchange and Lyons Avenue, a safety roadside rest is planned for Los Angeles-bound traffic. This rest area, will include parking spaces for both automobiles and trucks, with picnic and comfort facilities, and will also afford visitors a convenient opportunity to consult their road maps before entering the Los Angeles metropolitan area.

Drainage

Drainage has been a major consideration in design. A problem immediately south of the community of Castaic has been recurrent flooding of frontage road and expressway roadways due to large volumes of sand washed down from hills immediately west of the proposed freeway location. Culverts have periodically become plugged because of transported sediment deposits at and above their entrances as well as poor outlet conditions. New construction proposes three debris basins at the most troublesome canyons for storage of material carried by the waters. Passage of the clear flow through enlarged freeway culverts should alleviate this problem.

The existing Ridge Route looking north from Paradise Ranch with the projected relocation shown by the broken line (upper right).

NOV 17 1965

Silent cannons sleep under spreading shade trees at old Fort Tejan. Once a military post, the fort is now a State Historicol Park and one of the most colorful landmarks along the Ridge Route.

Rolling horse and cattle country north of Costaic still has not felt the urban push but the land these horses graze on may soon be too valuable to keep them there. The view is west toward the present highway.

The Rolphs' ranch house today overlooks mossive construction activity on the new Interstate 5 Freewoy. Mrs. Mary Ralphs stands in the front yard.

Extremely high cuts and fills in the National Forest area required special design at seven locations, including six reinforced concrete arches and one multibarreled structural plate pipe. These seven locations were the subjecr of an extensive material foundation investigation which resulted in recommendarions for bedding, profile grade and alignment which would minimize differential settlemenr for the concrete arches. In all, some 69.1 million cubic yards of earth will be moved in constructing these 45 miles of freeway. *This is 27 percent more than the figure of 54.2 million cubic yards moved to construct the Aswan Dam.*

The multibarreled structural plate pipe mentioned above is located in Apple Canyon. This installation was considered the only feasible solution to offset the extreme differential settlement expected. The 140-foot fill requires specially fabricated heavy plates. Instrumentation at this culvert is contemplated in order to measure settlement and embankment pressures, to verify design theory in practice.

Trucks

Included in the highway design were provisions reflecting the heavy volume of trucking which the route will carry, not only weighing stations which will be operated by the California Highway Patrol, but also areas where truck drivers can conveniently check their loads and their brakes and other equipment ar the top of long downhill grades.

The southbound weigh station will be located within the interchange area with Route 405 (San Diego Freeway) near San Fernando. The northbound one, combined with an inspection area, was recently constructed between Saugus and Castaic Junction.

One of the inspection areas for truck drivers will be constructed north of Castaic at Whitaker Summit, in advance of the five-mile southbound 4 percent downgrade. At Holland Summit, north of Gorman, grading will include provision for a future roadside rest complete with truck inspection facilities. An area for load and brake inspection was provided earlier in advance of the Grapevine Grade in Kern County.

Summary

Designing an 8-lane Interstate freeway to serve the country once crossed in four back-breaking days by horse and wagon has involved cooperation with all the usual public and private agencies, plus the State Department of Water Resources and the Forest Service. Planners have been presented with geological challenges by its highly differentiated landscape and its proximity to the San Andreas Fault. And, the construction phase has been approached under the pressure of a constantly mounting volume of traffic, both commercial and private.

The first 50 years on the Ridge Route were the hardest. Now, as the second half-century is entered, obscure places with picturesque names like Violin Saddle, Grasshopper Canyon, and Hungry Valley, will soon become familiar and highly accessible locations.

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"a renaissance in engineering"

creating space age highways

California Highways and Public Works
September–October 1965

One expert recently said that highway engineers have as much need for modern computers as those working in the space industry. In California, where the Division of Highways has been using data-processing equipment since before World War II, this is becoming more apparent each year.

Back in 1957 when there was some concern regarding a shortage of engineers, Harmer E. Davis, Director of the Institute of Transportation and Traffic Engineering of the University of California, pointed out that the day of the computer had arrived, and observed: "You might say that we are now in a position to do for the drudgery of highway engineering what power equipment has done for the hand labor of highway construction. As one speaker remarked, these technological improvements 'can make the engineer the master of his tools rather than the slave of his calculations' . . . Here is a renaissance in engineering."

renaissance grows

Today, some eight years later, this "renaissance" is stronger than ever. The machines are doing most of the routine tasks in accounting, and compiling great masses of traffic data. They can compute earthwork quantities, vertical alignment, route distances, areas, "traverses," and even draw cross-sections of roadways at any point specified. The engineers, freed of these detailed chores, are now able to devote their time to broader aspects of engineering.

In the fields of urban planning, for instance, complex studies such as the "LARTS," or Los Angeles Region Transportation Study, would be literally impossible without computers to do the incredible number of detailed computations required. This study, a continuing one involving 5 counties and 122 cities, seeks to analyze the movements of nearly 8,000,000 people who live

in 568,000 apartments and more than two million houses spread over 5,776,000 acres. They own 3,437,000 automobiles and require the services of 409,000 trucks to keep them fed, sheltered, and happy.

With 5½ million slots into which to drop information, organizing and computing the totals would require thousands of employees, a huge building or series of buildings, and months or possibly years of work. With computers which occupy a few hundred square feet of floor space, the information can be transferred to punched cards and fed into the tiny magnetized-iron, doughnut-shaped coils of the memory banks. When the study is complete, it will return the information in a few hours, all neatly organized in any arrangement which has been directed.

trip analysis

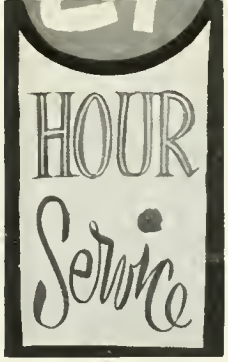
In this case the computers reported private vehicles in the study area make 12,342,000 trips, and the 409,000 trucks make 1,803,000 trips, for a total of 84,541,000 vehicle-miles each day. The computers further indicated which were shopping trips, work trips, and "other." Also shown was average vehicle occupancy, which varies with the type of trip. Work trips have the lowest average occupancy—1.2; while understandably, recreation trips are highest.

From the data which have been stored in them, the machines can provide all sorts of additional information for special charts and studies; such as median age, median income, population density, and distribution of commercial and residential units. Without computers each set of statistics such as this would require a laborious file search on the part of hundreds of workers. The machines can furnish it in a few hours by drawing it in prearranged order from their memory banks.

When all these figures are in, a "model" can then be constructed. From this many other figures can be interpolated such as 20-year predictions on land use, population density, cars owned per family, and other information vital in the study of highway networks.

rapid transit too

Future estimates will consider not only vehicular trips, but also take into account possible diversion of trips into rapid transit systems. In other words the computers will analyze the changes in "people movements" in the future should new modes of travel become available and popular.



in at night . . .
out the next morning.

The machines have for some time proved of great value in the field of right-of-way engineering calculations. Only a decade ago this portion of highway planning was a precise but time-consuming operation which kept dozens of young engineers occupied in each district, not only computing the areas involved, but also checking on each other's calculations.

A "traverse" or trigonometric computation of boundaries enclosing an area of land, when done by a human mathematician, and checked by another, may take anywhere from one to several hours; the computer does it in a few seconds, and so accurately no checking is needed. The only vertification needed is a recheck on the data supplied the machine.

deeds and condemnations

Last year the Right of Way engineering staff used traverses to prepare 9,000 deeds, 9,000 appraisal maps, 4,500 condemnation descriptions, 1,000 descriptions of abandonment and relinquishment maps, and 1,800 director's deeds.

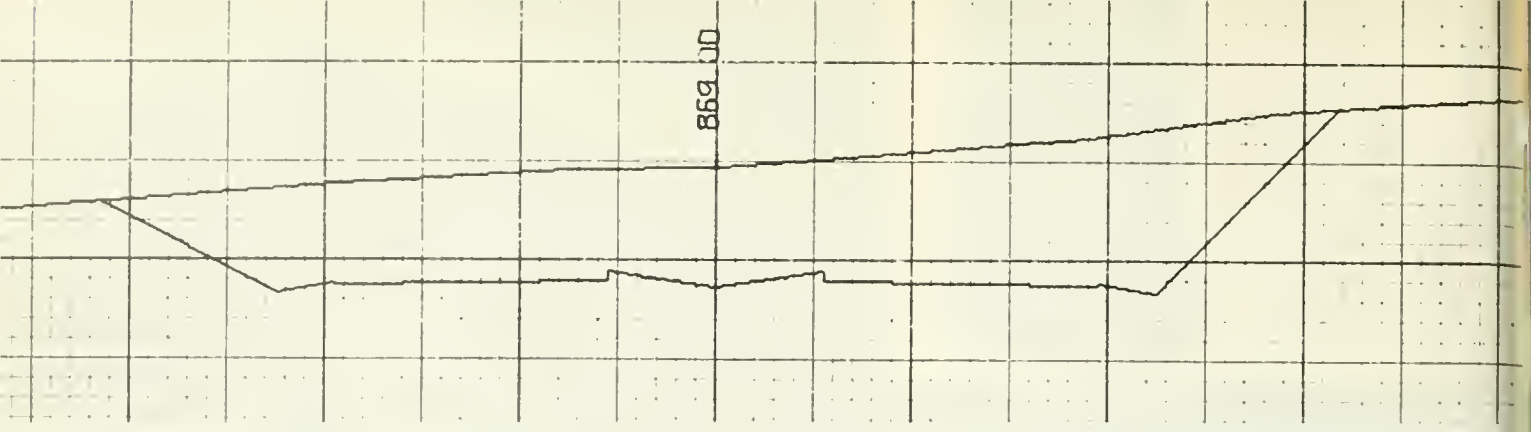
In modern bridge engineering, computers are used in many ways. Traverse computations have many applications in design of structures, as do the complicated mathematics involved in vertical alignments. There are many special programs—test, experimental, and unique problems—which require special machine setups outside the routine approach.

Obviously, structural analysis in general offers a multitude of opportunities for using the machines to do the repetitive and lengthy calculations involved. A prestressed concrete girder understandably takes its load in a different manner to that taken by a steel beam. A steel beam which is physically joined to a concrete deck above becomes a composite beam which has different characteristics again. All of these structural elements have "moments," or tendencies to bend, which are distinct from the others in quality but not in direction, since all are subject to compression, twisting, and tension.

These forces and moments have been measured and calculated for most known substances, so that their determination is a function of their volume or thickness or depth or length or other limiting factor. Since moment varies at every point between the center and ends of a span, the calculation of the correct size of a given material to carry a required load is a detailed, time-consuming problem. Today, computers do problems of this sort with ease and infinitely faster than a man can do them.

stresses, loading, settlement

Important calculations such as frame analysis, to examine structural behavior



under many different loading conditions, can be computed in a matter of seconds. Problems regarding influence lines, tunnel and arch stresses, force and concrete strength of prestressed girders have been programed for computer solution. From the data furnished by the machines, engineers can estimate total settlement of bridge approach fills or compute volumes of excavation for bridge abutments and piers.

Traverses are used in the horizontal layout of a structure, and one structure may require hundreds of such calculations. The length of the straight girders needed to carry a curved roadway is one example. This is even more complicated when the curved structure is "skewed." All sorts of traverse problems are involved in the location of points for various construction purposes which relate to each other.

Computers also are becoming increasingly important in all phases of highway design. The omnipresent traverse is again a constant problem, including many with three or more courses, or sides, with at least two unknowns. These calculations were once the province of young engineers who had to work them out, but the headquarters office machines handle them now for all the districts. Service is about the same as for modern film developing. When the requests come in at night, they go out the next morning.

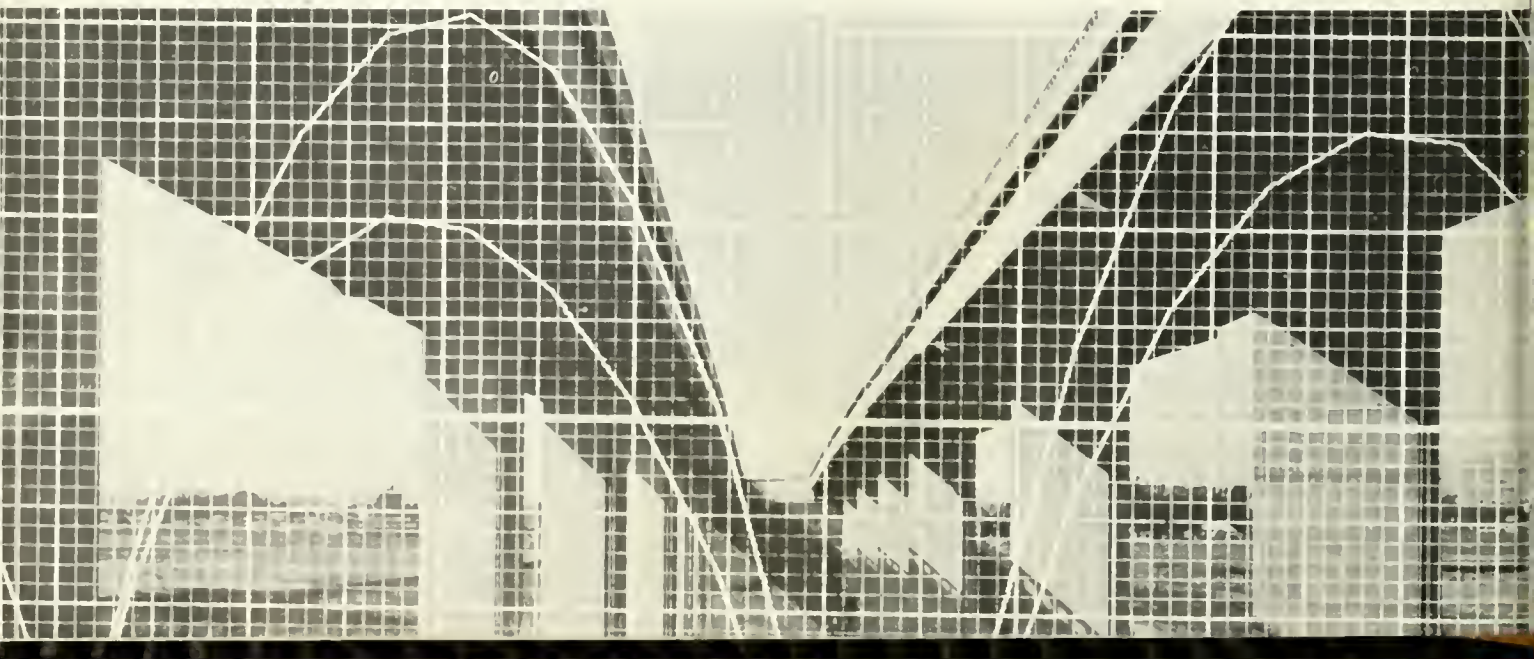
In the design of cut and fill sections for highways, there has always been a great amount of time-consuming computation involved in the development of cross-section plots, planimetering cross-sections, areas, and the calculation of quantities. Until a few years ago, this work was done by engineering personnel. Today the computer completes a cross-section in a few seconds.

man-hour savings

The traverse program is very popular. Usage varies greatly from month to month, but more than 210,000 traverse courses are computed monthly at an estimated saving of three man-minutes per course, resulting in savings in the neighborhood of 10,000 man-hours monthly.

In 1964, a study which compared certain freeway traffic routing procedures showed the cost of manual routing was $3,500 and mechanical routing $1,044, a saving of nearly $2,500 per assignment. Of particular importance was the reduction of mapping and coding time—74 man-days reduced to 18.

A major advantage of the mechanical routing procedure is that the rout-



The artistry of the computers is shown by this machine drawn earthwork cross-section.

ings are consistent. In manual routing, where usually more than one person is doing the work, inconsistencies naturally can occur.

new accident analysis

Accident information has been collected and studied for years, and any suspicious clumping of accidents on a specific section of road is immediately investigated. A new and more sophisticated accident analysis is being developed in a special project now under way at headquarters. Statistics on the 120,000 accidents now occurring in California annually are being fed into the computers to get information on a statewide basis in many categories. Tabulations are being made available which will aid in the identification, priority rating, and analyses of accident problem locations.

In the early thirties, before the computer age, the Highway Planning Survey Department (now the Urban Planning Department) was using machines to process statistical data in punched cards. In addition to research projects, machine tabulating methods were used to assemble traffic data, such as origin and destination statistics, into meaningful reports. Gradually, the division turned from handling a relatively small amount of statistical and traffic data,

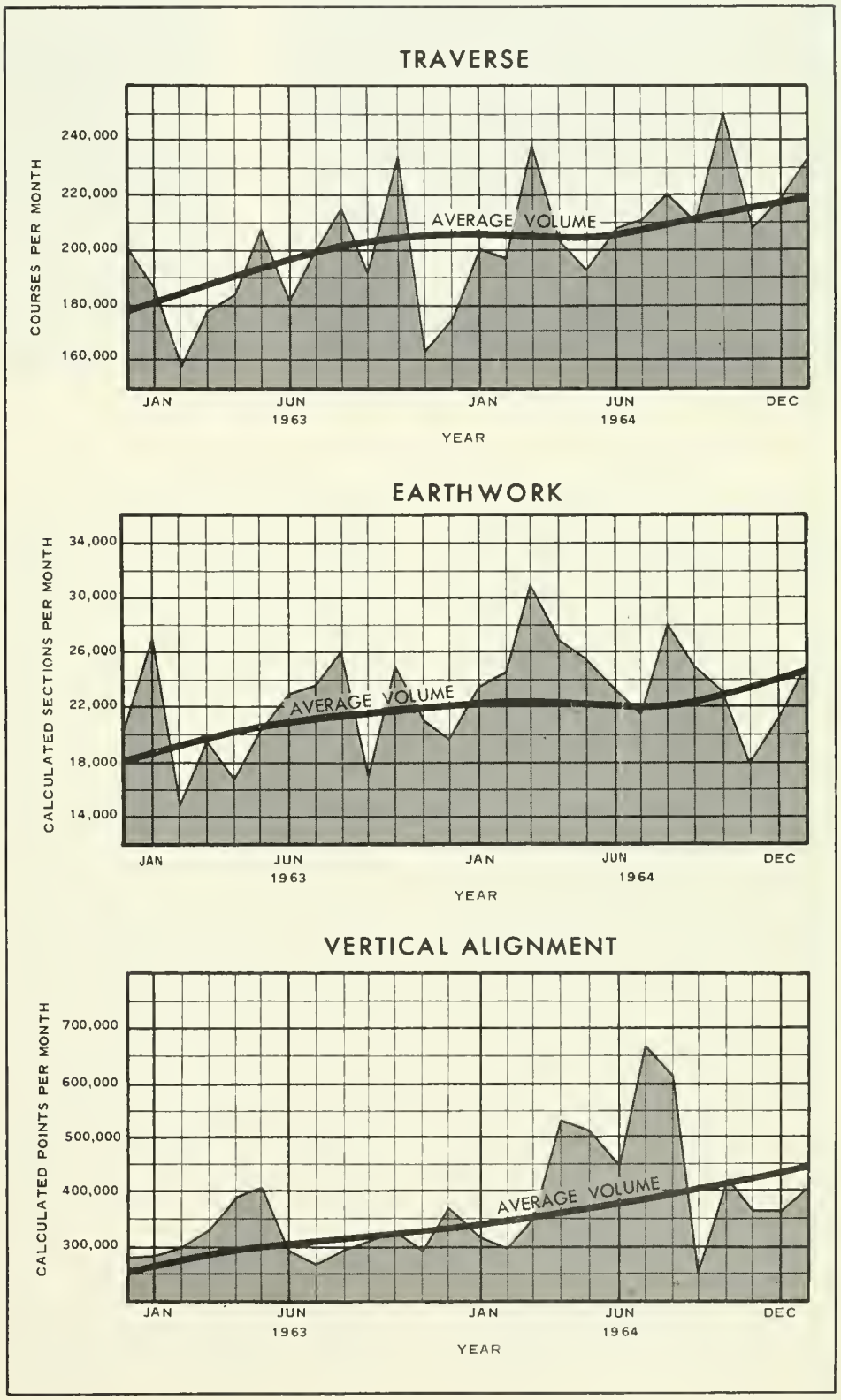
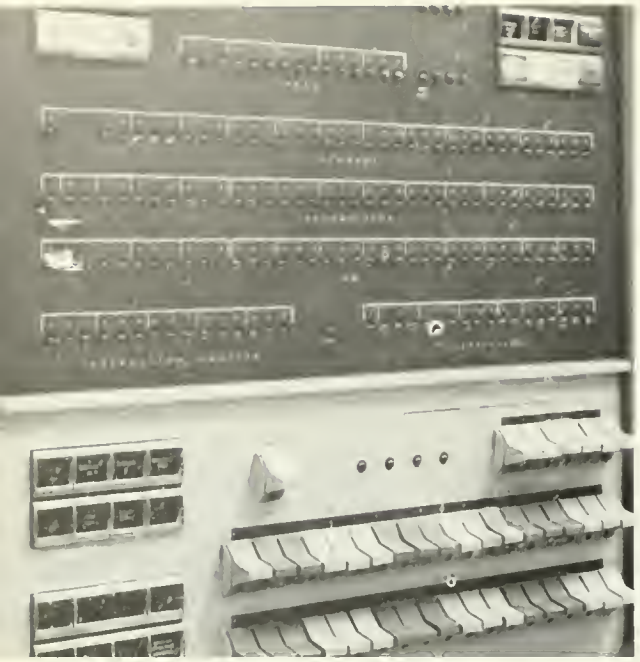
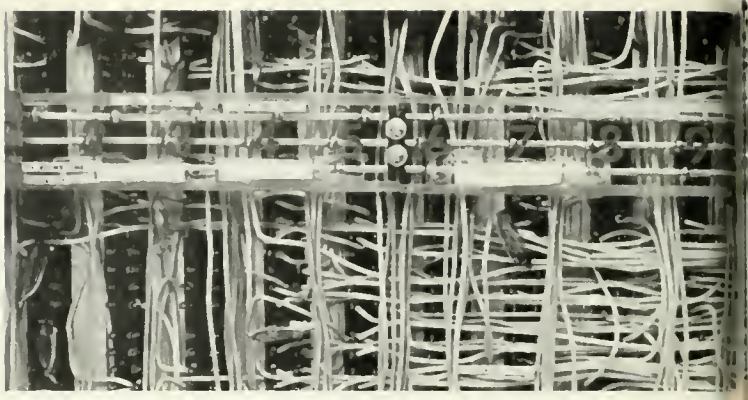


Diagram superimposed on photo is one drawn by machine showing maximum positive and negative moments.





new tools . . .
to meet new needs.

to more ambitious demands for processing great volumes of data through complex and high-speed calculation.

Between 1954 and 1957, the division acquired two IBM 604 calculators and then two IBM 650 computers. The designed capabilities of these machines provided the means to create a system which solved such engineering problems as traverse calculation and earthwork quantities.

machine orientation grows

Thus, by 1961, when the second generation computers were available, the Highway Planning Survey Department was well established as a machine oriented installation. By this time also, the machines had taken over many accounting calculations.

Since 1961, the division has acquired two IBM 1401 computer systems, an IBM 704 computer system, and IBM 1460 computer system. These computers not only handle such routine matters as statistical, accounting, and management reports but assume a much larger role in traffic assignments and improved engineering calculations.

In the latter part of 1962, the consulting firm of Price, Waterhouse & Company was retained to analyze the division's organization and systems and to make recommendations which would optimize the efficiency of the division through electronic data processing. The accounting system of the Division of Highways was assigned top priority in this study. The consulting firm was directed to study the accounting system, data transmission, management reports, EDP organizational structure, new EDP applications, and recommend an overall electronic data-processing system.

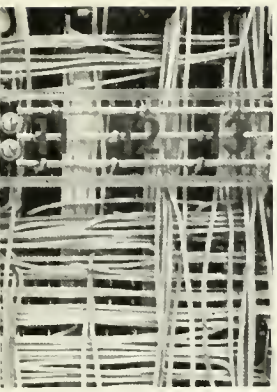
After a comprehensive study, Price Waterhouse provided detailed reports in 1963 which not only proposed use of EDP facilities for preparing current concise reports of cost and physical status, but also proposed an organization reappraisal by pointing out that a data processing department is a general service department which must meet the needs of a wide range of operating units.

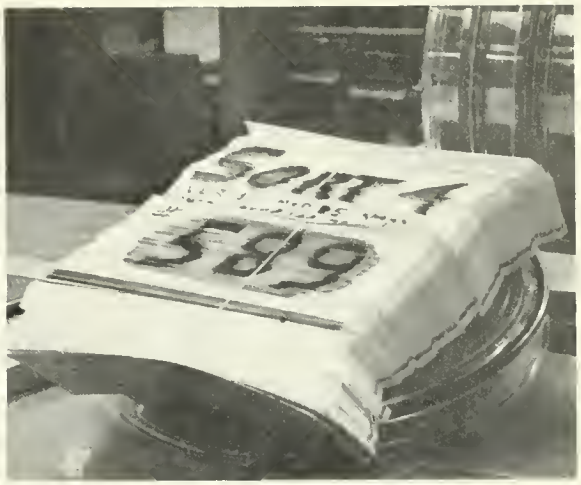
computer department

As a result of these recommendations, the Computer Systems Department was established in 1964. It is administered by a principal highway engineer, who reports to the Deputy State Highway Engineer, Administration.

Included in the department is an Advance Planning and Research Unit composed of engineers and statisticians with electronic data-processing experience who review and evaluate the procedures of the division to see how these procedures can be helped by the use of computing equipment. This unit develops new computer uses in the fields of highway engineering and management which would result in time and money savings in the division's operations. Essentially, this type of work is systems analysis, which includes defining the problem, reviewing and analysing existing practices, developing and testing new procedures, and instructing and training personnel to put the procedures into effect.

The computer industry has made giant steps forward in machine design and capacity. Generally speaking, computers today fall into categories of first, second, or third generation depending on whether their internal components are tubes, transistors, or microcircuitry. Simply stated, micro-





circuitry means miniature electronic circuits. These latest machines are capable of far greater speed than the computers we now possess.

Realizing the increased potential of this contemporary equipment, the Computer Systems Department has just completed studies looking toward the division's acquisition of a third generation computer.

for the future?

The impact upon our data processing systems by third generation computers cannot be foreseen or defined, but it is bound to be significant. Certainly a greater degree of automation will be possible which will mean faster service to the user at cheaper cost. Most challenging, however, is the prospect of more sophisticated applications because of such features and increased capacity and overall capabilities.

One important innovation, called time sharing or multiprograming, would allow each highway district to submit problems directly to the computer and receive solutions back in a short span of time via a district data-processing section. Equipment already developed would make it possible to equip each district console with a cathode ray tube repeater hooked into the main system in Sacramento. Whatever the operator types on the console shows in the tube, and he can check his work before releasing it into the system. On the simpler questions he can have a reply virtually instantaneously.

Equipment also available could provide the means for telemetering traffic data from all highways and freeways into a computer. The I.B.M. Corporation currently has a research project underway in San Jose to collect information on this type of use. Loops buried in the pavement count the traffic and speed of the traffic, and control the traffic lights.

electronic traffic police?

This type of control was not possible with the older type computers used in traffic control, for they could not differentiate speeds. If traffic jammed and began to move very slowly, the machine thought things were going fine, because it was only getting a few signals per period. Digital computers recognize traffic slowdowns and can be coded to take action. It is possible that in the not too distant future such machines will control freeway traffic, closing and opening ramps, and establishing speed control.

The new equipment should also give much more accurate and detailed traffic counting. Machines cannot only be used to count traffic and analyze its speed, but it is possible to hook up any number of counters to a central control via telephone wires. At desired intervals, and varying for each station if it is of value, the control station can "telephone" the counter on a conventional phone number and ask it for its count since the last call. Intervals can be as short as five minutes or less.

These are a few of the applications of modern electronic data processing to major highway problems, and a hint of some of the things to come. New applications are being discovered daily. In an industry which has gone from the marvel of the vacuum tube computer of a generation ago, to the miracle of today's microcircuit machines, infinitely more compact and infinitely more versatile, any attempts at specific long-range prophecy would be naïve.

I-8 East of El Cajon

By F. H. KREFT, Resident Engineer

San Diego is now the third largest city in California with a population of 641,000. There is an additional 600,000 population in the adjacent communities.

This rapidly expanding metropolitan area is located in the extreme southwest corner of the state. This location contributes to land transportation problems, as traffic is limited on the west by the Pacific Ocean and on the south by the International border. The greatest number of commodities and people are transported upon highways to the north and to the east.

The major arterial highway to the east is Interstate 8—an important part of the interstate highway system. This highway traverses San Diego and Imperial Counties, a distance of 180 miles before reaching the Arizona line at Yuma.

This route provides access to a seaport for the Imperial Valley, one of the largest agriculture producing centers in the nation. Construction on this route is complicated by mountains, deserts and vast distances.

By 1972 it is expected that this arterial will be completed through these two counties at an approximate cost of 200 million dollars.

Looking west on Interstate 8 towards El Cajon showing the connection with Business 80. In the foreground is the Greenfield Drive interchange and Broadway undercrossing.

Eleven Jobs Completed

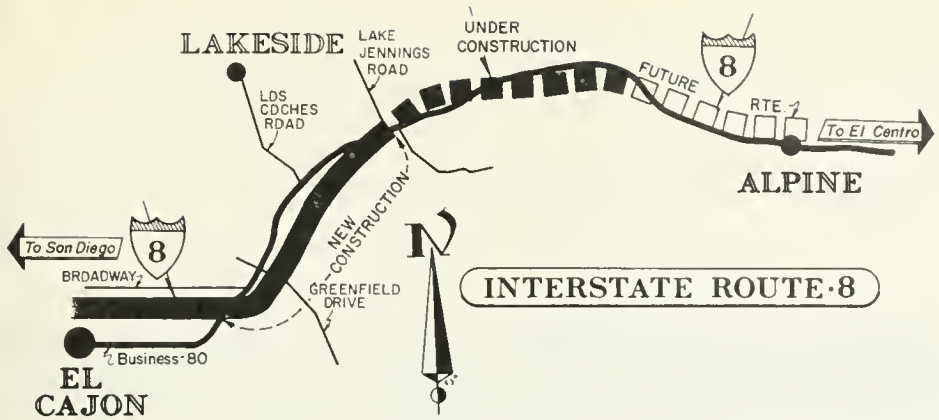
Previous years saw the completion of 11 construction contracts on Interstate 8, providing an unbroken 17 miles of freeway from its western terminus at Interstate 5 (US 101) in the Old Town area of San Diego to the eastern edge of the City of El Cajon at a total cost of 30 million dollars (see the 1961 September-October issue of *California Highways and Public Works*).

This year has seen the completion of another four-mile segment of this freeway easterly to Lake Jennings Road. This section provides a direct route in and out of El Cajon with a saving of time and distance. It features the elimination of both the "Tunnel Hill" grade and the traffic bottleneck at Greenfield Drive.

Work began on this segment in December 1963 with the award of a contract to the Daley Corporation. Work was completed in July 1965 at a cost of $3,446,265. The contract was designed and constructed for ultimate eight-lane development. However, only four lanes were paved at this time.

Excavation Furnishes Subbase

Roadway embankment and aggregate subbase for the contract were



A four-mile section of freeway west of Lake Jennings Road was completed in July. The section east of the road is now under construction.

obtained from roadway excavation; 1,590,000 cubic yards of roadway excavation were required. Considerable amounts of this excavation could be moved with conventional rubber-tired earthmovers, more than one-third of the excavation was rock and required drilling and shooting. The rock work was so extensive that more than a year was required to complete the roadway excavation.

Most of the excavation could be hauled without interference to the traveling public. The small portion that was hauled across existing Highway 80 required considerable traffic safety precautions to protect the motorists. Two flagmen were stationed at the crossing and they were equipped with two hand-operated, battery-powered eight-inch stoplights. Crossing was limited to weekdays between 8 a.m. and 4 p.m. to further eliminate inconvenience.

The largest percentage of the rock excavation came from the "Tunnel Hill" cut. This cut was over 120 feet in height and featured 1:1 cut slopes with a 20-foot-wide bench 50 feet above the shoulder. The cut slope above the bench on the south side of the highway was not stable and required laying back to a slope of 1½:1.

Tunnel Hill Problem

"Tunnel Hill" had previously been a problem to the motoring public. The steep grades and narrow width of the existing Highway 80 over this hill had become a major traffic bottleneck. Elimination of this grade and the intersection at Greenfield Drive is responsible for a time saving of approximately 5 minutes for trucks traveling Interstate 8.

Construction of the drainage facilities and bridges was performed simultaneously with the roadway excavation. Seven reinforced concrete box culverts were required, including one 444 feet long across Los Coches Creek. Three "tee" girder bridges were built on the contract. Two bridges simply span cross streets at Broadway and Los Coches Road. The bridge at Greenfield Drive was part of a full-diamond interchange. Embankment construction at the Los Coches Road Undercrossing provides for future development of a diamond interchange when traffic warrants.

Superintendent for the Daley Corporation on the contract was Robert Cadwell and project manager was Harry Muns. The writer was resident engineer for the Division of Highways. Glen Carver was the Bridge Department representative.

Two projects are presently under contract to the east of Lake Jennings Road. Upon their completion in 1966 another six miles of Interstate 8 will be improved to freeway standards.

Looking west on Interstate 8 toward the Los Coches Road undercrossing with adjacent grading for a future interchange. Beyond is the Tunnel Hill cut.

Statistical Specifications?

Analysis Phase of Quality Control Study Raises Many Questions

By JOHN L. BEATON,* Materials and Research Engineer

During the past year, California has cooperated with the U.S. Bureau of Public Roads in their regional workshop study of quality control. The purpose of this study is to make a statistical analysis of highway materials control tests and to develop statistical specifications for control of construction. Several states are involved in this study.

When we started our program, we came to the conclusion that it was really a two-part study. The first part consists of statistical surveys of specific construction items. This part would require planning, time, and staff, but would not present any great difficulties.

The second part, the preparation and evaluation of statistical specifications, we felt would be a more complicated subject. This would require a long, serious look at the data collected in these surveys and a close study of present practices. It would also lead us into an area where we have limited experience and so must move forward slowly and only as experience is gained.

Items Included

The construction items included in our survey are as shown below:

Construction Items	Tests
1. Roadway Embankment	a. Relative Compaction Test
2. Untreated Base Material	a. Sieve Analysis b. Sand Equivalent c. R-value
3. Subbase Material	a. Sieve Analysis b. Sand Equivalent c. R-value
4. Cement Treated Base	a. Determination of Cement Content
5. Structural Concrete Aggregate	a. Sieve Analysis b. Sand Equivalent c. Cleanness
6. Plastic Concrete	a. Slump of PCC (Kelly Ball Method)

* Condensed from a paper delivered before the Conference on Research and Development of Quality Control and Acceptance Specifications for Materials and Construction using Advanced Technology, Bureau of Public Roads, Washington, D.C., April 5–7, 1965.

Norman Schmautz of the Bridge Department prepares concrete aggregate samples for shipment to the District Laboratory. Samples shown represent approximately 1,200 tons of aggregate.

In addition to the samples taken in the field, we are also analyzing certain laboratory data we have on file for the following items:

Construction Items	Tests
7. Portland Cement	a. Expansion in Water and Contraction in Air (Mortar) Calif. Test Method No. 527
8. Corrugated Metal Pipe	a. Thickness of Galvanizing
9. Paving Asphalt	a. Penetration Test

The field sampling and testing involved in our program was carried out by the various districts and the Bridge Department. However, it was independent of and in addition to the normal job control. The items were not statistically analyzed until after the operating job personnel had indicated them to be acceptable. The men assigned to this work were all well experienced in construction materials sampling and testing. They were selected for their competency so as to

minimize variations due to sampling echniques.

Districts Allowed Freedom

Each district was allowed freedom n doing its portion of the study within, of course, the necessary experimental limits. Headquarters Laboratory provided the project engineers with four examples of random sampling and allowed them to choose he method which best fit the particular operation. These were: (1) random time, (2) random batch, (3) random location, or (4) random length along a windrow. A project coordinator from Headquarters Laboratory visited each job at least once and most jobs two or three times. He observed the sampling and testing procedures and talked directly with he people doing the work.

To date, we have completed all the field sampling and most of the testing. An IBM 7-04 computer program was written to analyze this data. The first item, earthwork embankment compaction study, is completed. Figures 1, 2, and 3, show the distribution curves obtained on the three jobs included in this study.

Project No. 1 (Figure 1) had relatively shallow fills of a homogeneous material placed over a valley floor. The materials and placement approached very nearly an ideal condition. Eight and one-half percent of the tests were below our specification of 90 percent relative compaction. In other words, we did as well on this project as reported for the AASHO Road Test. They had 8.8 percent below specifications. Our range on this job was from 87 to 98 with an average of 92.9 percent.

Second Project

Our second project (Figure 2) was constructed over rolling terrain with the earth being a mixture of clay and stream-rounded cobbles. It represents about an average variation in material and compaction control. Thirty seven percent of the area under the curve is below specifications; 49 percent of the tests shown on the histogram are below the established limit.

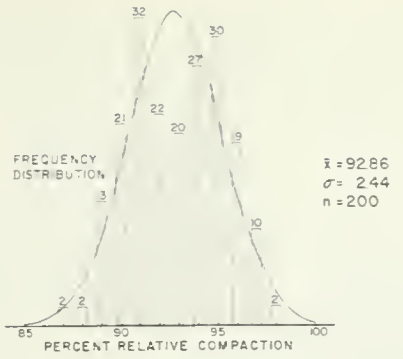


FIGURE 1

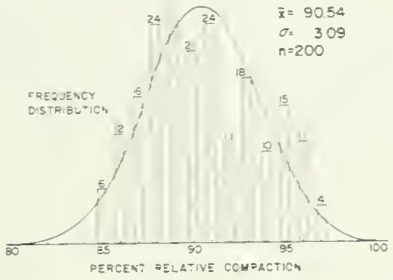


FIGURE 2

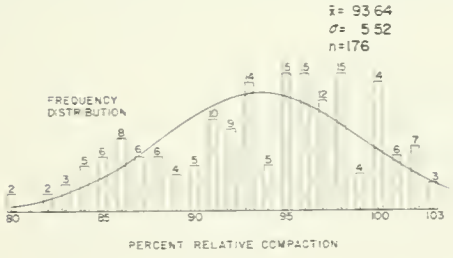


FIGURE 3

ROADWAY EMBANKMENT STUDY GRAPHS: Project 1 (top) had relatively shallow fills of homogeneous material placed over a valley floor. The materials and placement approached very nearly an ideal condition. Project 2 (middle) was constructed over rolling terrain with the earth being a mixture of clay and stream-rounded pebbles. It represents about an average variation in material and compaction control. Project 3 (bottom) is located in rugged north coastal region of California in unstable, nonuniform and wet terrain.

The range is from 85 to 97 with an average of 90.5 percent.

The third project (Figure 3) is located in the rugged north coastal region of California, and the terrain could be described in three words—unstable, nonuniform, and wet. It varies from sandstone to soft clays and approaches the maximum in difficulty and variation of placement and materials. 23 percent of the area under both the curve and the histogram was below specifications. The range is from 80 to 103 with an average of 93.7 percent. It is interesting to note that although this project had the greatest dispersion, the average was the highest of the three.

Observations Made

With the above three projects in mind, and remembering that these are all good jobs that fully comply with specifications, we can make the following two observations:

(1) Variability in compaction is a measurable quantity requiring recognition. The basic variability is in the material or process and would remain essentially unchanged regardless of the method of testing, be it nuclear, sand volume, water balloon or any other method;

(2) The change in variability from project to project even within one state, at least in California, can be very large. Any statistical specification which places restrictions on the use of engineering judgment must allow for these large differences in conditions. In other words, it may be necessary to have several statistical specifications, at least as far as its limits are concerned, even within one state.

As stated earlier, this study is divided into two phases; we are now approaching the second phase, and following are some of the questions that we are starting to discuss:

1. Will the use of statistical specifications significantly increase the cost of construction?
2. Since the specification would be based on the premise that the test results will be normally distributed, do we not have problems accepting or rejecting the first few lots? We certainly cannot wait until the fill

(or other item) is built before making a decision.

3. When a material has been rejected by the state, and reworked by the contractor, as is often the case when building earth embankments, how much reworking is required before we have a new universe from which to draw a sample? In other words, how would we know that we are not resampling the same or a slightly altered universe, thus increasing the risk to the state of accepting poor quality material? (See Figure 4.)
4. The entire area of rejecting material may require additional thought. The rules of rejection used today may not be applicable when using statistical specifications. Perhaps a different sampling plan or variation limits would be needed for material requiring reworking and blending.
5. The point in the construction process where sampling should be done may require greater definition for statistical specifications than for our present specifications; or perhaps we should be thinking about process control specifications performed under supervision by the supplier and contractor, with end point acceptance specifications by the state. If so, what happens when a completed item is rejected by end point specifications?
6. Since the number of test samples must be specified, does it not follow that some procedure must be established to assure that the testing process is in operational control? This might involve control charts or other records which will be needed for each field test involved. Should this be included in the specifications? We have to be sure that the testing precision assumed in the specification can be duplicated in the field.
7. Undoubtedly, many of the present AASHO and ASTM test methods will need to be updated to establish procedures for measuring the precision of a testing unit. And, of course, all such specifications will need to be adapted to the statistical approach.
8. A question arises as to what should be in a specification and what should be in a test method. In other words, should the limits be specified in the contract document with tolerances established in the test method? Also, in which of the documents should the sampling method be presented in greatest detail?

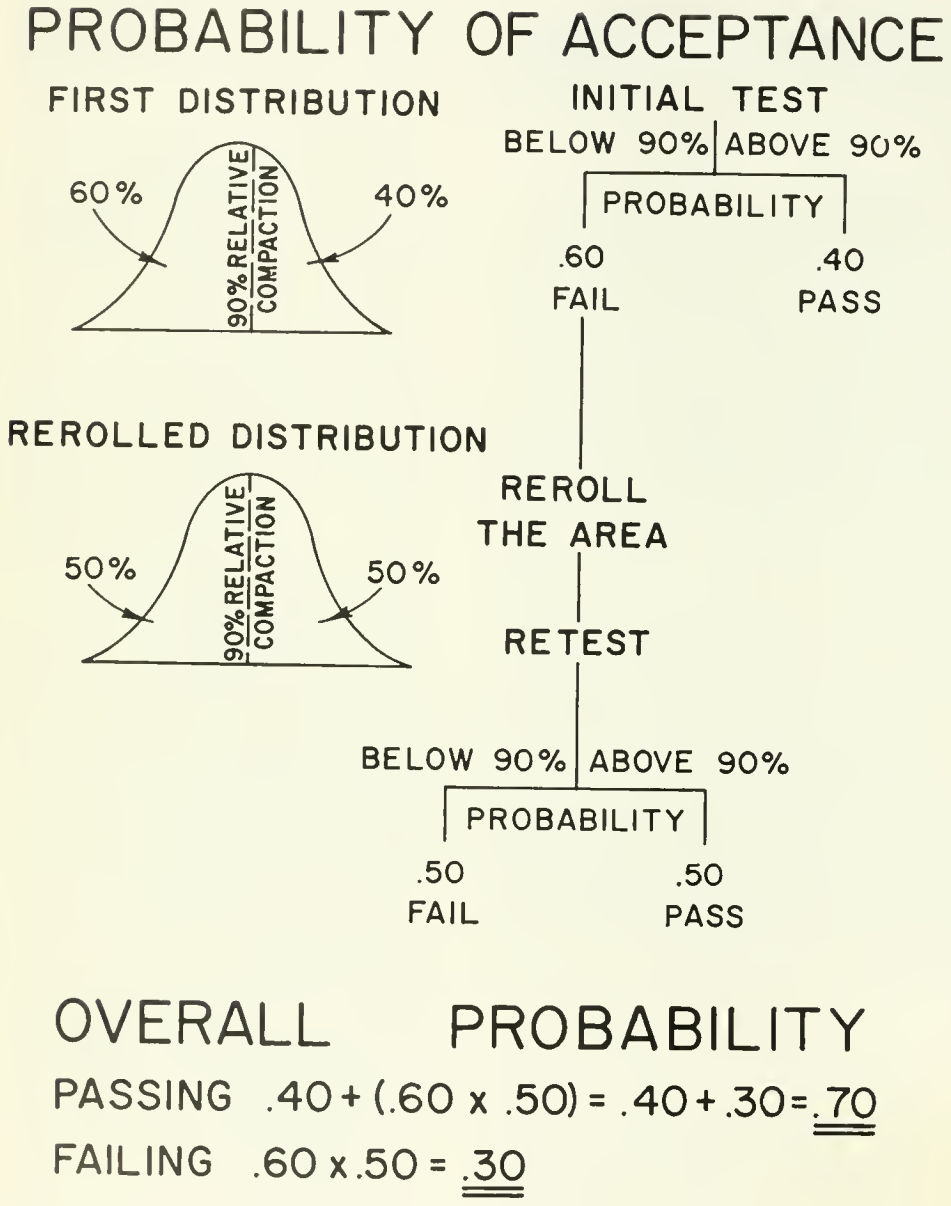


Figure 4 shows how resampling affects the probability of accepting earthwork. With the distribution of a lift as shown, 40 percent of all possible test results would pass; this means that the probabilities of a test result complying with the specifications is 40 percent. If the test result falls below the specification limit, rerolling and retesting is required. Assuming that a test result from the rerolled lift would have a 50 percent chance of complying and because retesting is performed only when a sample fails, the total probability of acceptance would be 70 percent as shown in the figure.

Don Sturtevan of District 11 samples aggregate bose from windrow. Nate procedure followed in removing a complete section from the windrow and splitting the sample immediately.

9. Will the adoption of statistical specifications interrupt the trend toward end result specifications?

In addition to the foregoing points, we should always keep in mind that no specification is limited to the content of the legal document. In the final analysis there will always be borderline data — unforeseen construction problems and other circumstances requiring a judgment decision, regardless of the type of specification used. At the very best, a statistical specification can only *assist* the engineer in making the decision. We may find that the statistical survey done in one state may not be applicable in all other states because of the varying level of enforcement or of laws or of attitudes. We should also bear in mind that the unwritten portion (policies, attitudes, etc.) of any specification will vary from state to state and from agency to agency.

Use Study Needed

In raising these questions, we do not intend to imply they are beyond solution or that statistics is not a valuable engineering tool. Our point is that the use of statistical specifications must be carefully analyzed. It is a new approach to control of highway construction and if improperly administered could lead to excessive costs without commensurate gains in our highway serviceability. On the other hand, statistical analysis has always been a part of our special studies programs and we feel that the additional coverage we are gaining from this study of many of our standard construction items will give us information in some areas where we have only guessed in the past.

Federal-Aid Chief McGinness Retires

Gillette G. McGinness, Chief of the Federal-Aid Section of the State Division of Highways, will retire on November 30 with more than 38 years of service.

McGinness joined the division as a messenger in 1926. He worked as stake puncher, chainman, rodman and levelman on survey crews including the Feather River Canyon in 1929 and the Redwood Highway in 1933.

G. G. McGINNESS

He became an engineering aid in 1933 and a junior highway engineer in 1936. From then on he advanced through the professional ranks becoming assistant stores engineer in 1949. He became head of the Service and Supply Section in 1953 and was promoted to assistant office engineer in charge of the newly formed Industry Contact Section in 1958.

He became assistant officer engineer in charge of the Federal-Aid Section in 1961.

McGinness was born in Richmond, California, and attended grade, high school and junior college in Sacramento. He later attended courses at Sacramento State College.

McGinness is a Mason and a member of Sacramento Lodge No. 40.

He and his wife, Aurora, have two daughters, Mrs. Gordon Owes of Portland, Oregon and Mrs. Robert Manning of Oroville.

The McGinnesses will make their home at Kyburz, El Dorado County, following his retirement.

The State Department of Public Works has awarded a $4,086,000 contract for constructing five miles of four-lane Interstate 580 between approximately four miles east and one mile west of the San Joaquin-Alameda county line.

Operation Transplant

By DONALD L. YOUNG, Highway Landscape Specialist

"Operation Transplant" is a plan under which District 10 saves trees along future freeway routes by finding them new homes.

The Redevelopment Agency of the City of Stockton recently purchased from the Division of Highways 64 trees located in the yards of the homes along the future Westside Freeway route. Twenty of the trees have already been moved into the Hunter Square Plaza and are now providing "instant shade." The remaining 44 trees are boxed and stored for transplanting this fall to the Main Street Mall of the West End Urban Renewal Project.

The trees include a southern magnolia, deodar cedar, camphor, silk

PHOTO ABOVE: Salvaged from a future Westside Freeway route this beautiful tree will provide shade for shoppers in downtown Stockton. PHOTO BELOW LEFT: This tree is 50 feet tall, weighs 25 tons and is estimated to be a half century old. It will be transplanted from a storage yard to the Main Street Mall in Stockton this October. PHOTO BELOW RIGHT: A 25-ton motor crane gently lowers one of the olive trees into a hole on the northeast corner of the Kansas Avenue interchange in Modesto. (Photo courtesy Modesto Bee)

tall palm tree finds a new home where old ighway 99 goes under the new Modesto Freeway.

ak, umbrella tree, and several olive nd Modesto ash trees.

Two types of hormones are being sed to make sure they survive the rdeal. One was watered into the soil round the trees before they were noved to slow down root growth—a mber tranquilizer, so to speak; the ther is applied after the tree is noved to speed up root growth.

During July, District 10 had 42 live trees and six Canary Island date alm trees, 15 to 45 feet high, transplanted from the median of Highway 9 in Salida to the new freeway hrough Modesto.

These trees were located in the path f future freeway construction and ere moved to selected locations beween Hatch Road and the Prescott oad Overcrossing. They were lanted as a part of a more extensive ndscaping program being planned or this new freeway.

This plan is another of the Division f Highways continuing efforts to rovide landscaping to harmonize ith the natural environment, while roducing an aesthetically pleasing ef-ect.

DIVISION ANNOUNCES RECENT RETIREMENTS

District 1

Verne A. Boulware, highway maintenance man II, 36 years.

District 2

Edwin E. Olson, highway maintenance man II, 21 years; Ralph H. Twaddle, senior highway engineer, 37 years.

District 3

James R. Keefer, light power shovel operator, 14 years; Roland I. Nicholson, senior highway engineer, 35 years; Marvin D. Schance, highway maintenance man II, 33 years; John O. Smith, forestry cook I, 13 years; Garlon G. Wilson, highway foreman, 37 years.

District 4

Robert M. Addison, highway maintenance man II, 15 years; Frank B. Lindsay, assistant highway engineer, 15 years; Mabel E. Seymour, intermediate file clerk, 14 years.

District 5

Herbert J. Holman, assistant highway engineer, 35 years; Fred C. Moore, supervising right-of-way agent, 29 years; Donald L. Robbins, tree trimmer, 18 years.

District 6

Preston S. Jordan, highway maintenance man II, 31 years.

District 7

Lena M. Barrett, highway field office assistant, 11 years; Abner E. Beard, highway maintenance man II, 26 years; Oscar W. Carlson, highway engineering associate, 18 years; Paul I. Zimmerman, engineering aid II, 3 years.

District 8

Mary Ann Jewett, intermediate clerk, 15 years.

District 9

Bliss A. Hinshaw, highway foreman, 25 years; Henry C. McAllister, highway maintenance man II, 27 years.

District 10

Leslie A. Anderson, highway field office assistant, 14 years.

District 11

Eugene A. Casey, assistant highway engineer, 32 years; Frank E. Hansen, highway foreman, 34 years; Clarence E. Harpham, highway engineering technician I, 17 years; George A. Thomson, assistant highway engineer, 34 years.

Headquarters Office

G. Glenn Eaton, intermediate clerk, 6 years; Baynard A. Switzer, senior highway engineer, 40 years.

Materials and Research

John R. Vincent, assistant steel inspector, 10 years.

Bridge

Ilmar O. Jahlstrom, principal bridge engineer, 37 years.

SHOPS

Shop 2

Valda V. Smith, heavy equipment mechanic Rg. A, 15 years.

Shop 6

Homer Young, highway equipment superintendent I, 34 years.

Shop 8

Ray S. Milnor, assistant highway mechanic foreman, 41 years.

Shop 9

Raymond P. Steffen, heavy equipment mechanic Rg. A, 7 years.

Shop 11

Edward H. Higginson, highway equipment superintendent I, 30 years.

'65 Legislation

When Governor Edmund G. Brown signed a proclamation on August 3rd which terminated a special extra cent per gallon tax on motor vehicle fuels his jubilance was understandable.

The tax was imposed by Senate Bill 268, introduced by Senator Randolph Collier, chairman of the Transportation Committee, to repair the roads and highways in the areas of northern California ravaged by last winter's floods.

This urgency measure went into effect on April 1st, and the act provided for its continuance for a maximum of nine months. However, the Governor's action ending it after only five months was based on progress made in the repair program and the acquisition of sufficient funds from federal and other sources to insure its completion.

Most of the legislation affecting state highway routes was embodied in the technical bill, SB 87, and the omnibus route bill, SB 81, authored by Senator Randolph Collier. As introduced, they contained the recommendations of the Department of Public Works. They were amended several times during the session to include other legislation introduced originally as separate bills.

Conflict Between Bills

Oddly enough, both bills were passed during the closing hours of the session and each made changes in California's freeway and expressway system, but since SB 81 was signed and chaptered later than SB 87, it automatically nullified any provisions of the earlier bill changing this network of access-controlled routes.

Conflict between the two bills was known prior to adjournment but efforts to reconcile them failed in the press of more urgent matters.

A total of 234.6 miles was added to the state's freeway and expressway system and 151.9 miles deleted, for a net gain of 82.7 miles. It now contains 12,497 miles.

Some of the more interesting changes made to the State Highway System were the addition of the long-awaited route through Mendocino Pass in the coastal mountain range, between US 101 at Longvale in Mendocino County, and Willows in the Sacramento Valley, Glenn County—a distance of 119 miles.

A 10.2-mile stretch of Mulholland Drive in Los Angeles County, between Route 27 and the San Diego Freeway (Interstate 405), was added to both the state highway system and scenic system as Route 268; the 4-mile Richmond-San Rafael Bridge was brought into both the state highway system and the freeway and expressway system as Route 17; and Route 170 was extended approximately 2

Emergency legislation added a temporary one cent per gallon to the gas tax to finance reconstruction of state highways damaged during the devastating Christmas floods of 1964. This photo shows a washout of a section of US 101 at Squaw Creek in Mendocino County shortly after it occurred in December, 1964. *(See photo next page)*

miles southwesterly to the Los Angeles Airport as a state highway in the freeway and expressway system.

On the other hand, the 4.7-mile Route 188 (Fallen Leaf Lake Road) in the Lake Tahoe area, an unimproved lane that few realized was in the state highway system, was dropped from it, and the section of Route 111 in Riverside County between Indio and Palm Springs was retained as a state highway but removed from the freeway and expressway system.

Agency Name Shortened

In addition to such bills as the one shortening the name of the "Highway Transportation Agency" to the "Transportation Agency," and that revising certain provisions of the Collier-Unruh Act affecting the "select systems" of city streets and county roads—both of greatest import to the technical staffs of the state, cities and counties—the Legislature passed and Governor Brown signed into law many measures of public interest.

These range from consideration of procedures for locating highways to highway aesthetics, safety, financing, toll bridges and rapid transit, and assistance to those forced to relocate because of highway construction.

Several bills sponsored by Assemblyman Z'berg related to procedures leading to the adoption of routings for freeways and other state highways.

To understand them, the following background information is needed:

The Legislature is responsible for determining the termini of state highways. Frequently, it will add such controls as "from A to Z via D, M and X."

Since routes cannot be laid out "as the crow flies," but rather are subject to such geographic, sociologic and economic controls as mountain and river barriers, parks and hospitals, and the costs of needed rights-of-way, the California Highway Commission is charged with choosing the best of the many alternate alignments studied.

In making such a determination, the commission considers the recommendations of the State Highway Engineer and the results of public hearings conducted locally by the Division of Highways. Whenever asked by a local government concerning locating a freeway, or on many occasions by its own motion, the commission itself will hold a public hearing before selecting the exact routing.

The section of US 101 at Squaw Creek (photo, previous page) following its reconstruction. Photo was taken on March 17, 1965.

Graphic Portrayals

Assembly Bill 1430 requires the Department of Public Works to present graphic portrayals, where appropriate, of significant portions of route alternates at public hearings in connection with state highway locations, when requested by any city or county affected. The portrayals may be by means of either sketches or preliminary models.

(Current operating procedure of the various highway districts calls for displays of aerial photographs with the proposed freeway superimposed to be shown in the lobby of the meeting hall and at the meeting via overhead projecture; artists' sketches and expensive scale models, with the degree of such visual presentation related to public interest and controversy.)

An amendment to the Streets and Highways Code (AB 1431) removed the direction in the law that the Highway Commission should establish state highways at the "most direct and practicable" location.

This new law will not cause a change in the commission's existing procedure, however, as the commission has long recognized the necessity of considering such community values as master plans for development, schools, economic impact of the routing on an area, cemeteries, and a host of other factors, as equally formidable barriers, and rightfully so, as geologic faults, bays and deserts.

A new piece of legislation, AB 1432, provides that a local agency may petition the Highway Commission for a hearing if it discovers during preliminary discussions between it and the state's freeway builders that it is dissatisfied with a proposed segment under study.

An addition to the Streets and Highways Code (AB 1435) now requires the Highway Commission to report why it determined on a specific freeway location, including consideration given to driver benefits, community values, recreational and park areas, historical and aesthetic values.

Legislation made the Richmond-San Rafael Bridge a part of the state highway system and the freeway and expressway system as Route 17.

the values of property, impact on local tax rolls, state and local public facilities, city street and county road traffic, and the total projected regional transportation requirements.

'Parkway' Is Defined

In the general field of aesthetics, Senator Fred Farr's bill (SB 725) defined a "parkway" and established a State Parkway Program.

The general concept of a parkway is of a park-like facility with a road meandering through it. It is so designed for low-speed, recreational driving that motorists may park to picnic, hike or bicycle.

Although the primary responsibility for the program rests with the Department of Parks and Recreation working together with the Advisory Committee on a Master Plan for Scenic Highways, the responsibility for the construction and maintenance of the roadway within the park rests with the Department of Public Works.

California's increased spending on landscaping and other plantings, reflecting the growing demand that roadways be as attractive as feasible, necessitates, of course, increased sums for the plantings already accomplished.

Senate Bill 1045 has amended the Streets and Highways Code to raise the amount which may be spent each year for the maintenance of landscaping and functional planting on state highways from $7,500,000 to $10,000,000.

Procedures Established

A bill (SB 134) which added Section 105.6 to the Streets and Highways Code, established procedures for the joint development of freeways and adjacent facilities for pedestrians, bicycles and other nonmotorized traffic.

Such facilities are to be constructed only where the Department of Public Works has determined that they will not constitute a safety hazard or interfere with traffic.

The total cost of construction and maintenance of such facilities will be borne by the communities requesting them. Highway funds will not be used, and the right of eminent domain will not be exercised to acquire property for such facilities.

Under safety may be classified such bills as Assemblyman Kennick's AB 346 which provided, unless otherwise agreed on, the cost of maintenance of railroad automatic grade crossing protection on any city street, county road or state highway, constructed or altered after October 1, 1965, shall be divided between the railroad and the public body involved in the same proportion as the original cost of the facility was divided.

It further provided that the Highway Commission shall set aside an amount not to exceed $1,000,000 annually for allocation to the Public Utilities Commission for paying the share of the cities and counties.

The '65 Legislature also appropriated $255,000 for expenditure by the Department of Public Works in a continuing program of research on highway safety.

The jointly sponsored SB 361 and AB 294 (Senator Collier and Assemblyman Foran) added seven sections to the Government Code and two to the Streets and Highways Code, authorizing moving payments to those persons or businesses displaced by state highway projects, as well as by projects of certain other state agencies, and authorized the Department of Public Works to give relocation advisory assistance to those families affected.

I-5 in South State Gets $8,209,000 Job

The State Department of Public Works has announced the award of an $8,209,574.75 contract in Los Angeles County for widening Interstate Route 5 (US 99) south of Gorman, from four-lane expressway to eight-lane freeway between 6.8 miles south and 0.6 mile north of Route 138; and also constructing Route 138 as four-lane freeway (with sufficient right-of-way for an ultimate eight lanes) 2.1 miles east of Interstate 5.

The project includes construction of interchanges with Quail Lake and Hungry Valley roads, and with Route 138, as well as a bridge across Gorman Creek.

New Route Adoptions

At its July meeting in Sacramento, the California Highway Commission adopted locations for nearly 30 miles of freeways on four routes in Los Angeles and San Diego counties.

Meeting the following month in San Francisco, the commission adopted a conventional highway routing for 2.8 miles of Route 187 in Los Angeles and Culver City, and designated a two-mile section of Waterman Avenue in San Bernardino as interim Route 18, pending freeway construction.

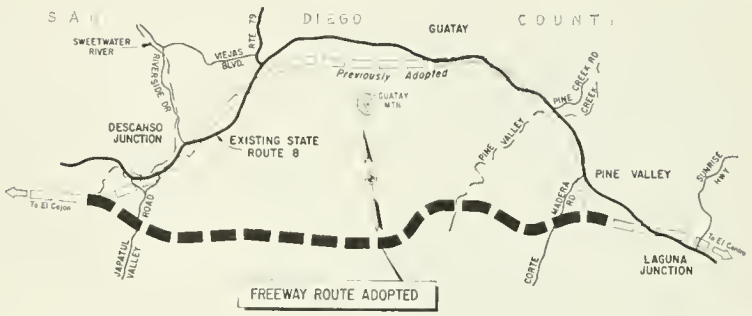
The Route 1 Freeway will extend between Vermont Avenue in Los Angeles and the Pacific Coast Highway at Colorado Street in Long Beach, connecting with a newly adopted section of the Route 22 (Garden Grove Freeway) between this point and the Los Cerritos Channel.

The two segments form a continuous 11.6-mile east-west freeway for which 14 alternate alignment combinations were studied and presented at public hearings in Long Beach by both the Division of Highways and the commission.

Plans of the Division of Highways call for the construction of an eight-lane freeway on both routes at a combined cost of $107,800,00, including rights-of-way.

In San Diego County, the commission revised a previously adopted routing for approximately 6.4 miles of the Interstate 8 Freeway between one-half mile west of Japatul Valley Road and one mile west of Laguna Junction.

This section was included in a 27-mile routing between east of El Cajon and Laguna Junction which was



adopted by the commission in March 1959.

In recommending the revision, State Highway Engineer J. C. Womack had told the commission that it would cost $2,800,000 more for construction and rights-of-way than the alignment previously adopted, but would save about $8,400,000 in 20-year user benefits.

He added that the revised routing would affect fewer homes and improvements, and avoid groves of oak and pine trees and two national forest picnic and recreational areas than would have been required by the previous routing.

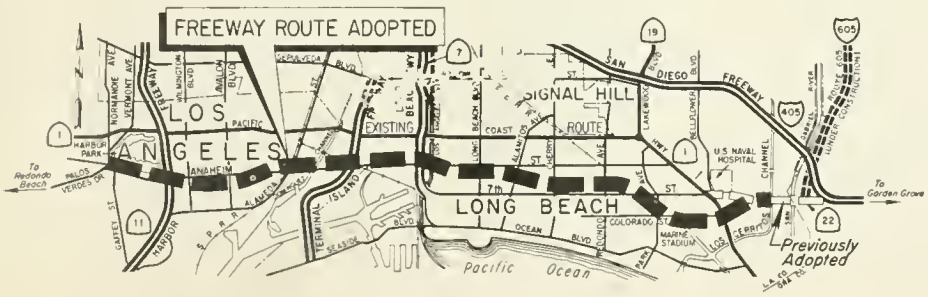
A four-lane freeway with a minimum median width of 100 feet is planned for this section at an estimated construction and right-of-way cost of $14,600,000.

In another San Diego County action, the commission adopted a freeway routing for 10.8 miles of Route 125 between south of Mission Gorge Road in the Santee area and the adopted alignment of the future Route 56 Freeway near Poway.

Although construction of this north-south belt-line freeway along the eastern fringe of the San Diego metropolitan area is not expected for a number of years, the commission determined the routing at this time to permit more orderly planning for anticipated local development.

The new alignment for Route 187 will carry traffic along Venice Boulevard for 2.8 miles, between east of Sepulveda Boulevard at the Los Angeles-Culver City border and the Santa Monica Freeway, just east of La Cienega Boulevard in Los Angeles.

The revised alignment of interim Route 18, Waterman Avenue between Route 30 (Crosstown Freeway) and the north city limit of San Bernardino, was requested by the city council and county board of supervisors to facilitate the movement of traffic to and from the mountains.



Grace Marie Hines Retires November 12

Grace Marie Hines, presently secretary to the Deputy Administrator of the Transportation Agency, and also secretary to many Deputy Directors of the Department of Public Works and California Highway Commission officials over the past 35½ years, will retire from state service November 12.

Since January 1959, Mrs. Hines has been secretary to Frank Chambers; first when he was appointed Secretary of the California Highway Commission, then Assistant Director of the Department of Public Works, and presently Deputy Administrator of the Transportation Agency.

GRACE MARIE HINES

Mrs. Hines' career with the state began in June of 1925, when she was employed as secretary to the Office Engineer of District 3, then located in the former Fruit Building at 4th and J Streets in Sacramento, before that district office was moved to Marysville. From 1933 to 1940 she served as secretary to Deputy Directors of Public Works Morgan Keaton, Ed Neron, Franz Sache, and Gus Henderson; and from 1940 to '44 was secretary to Director of Public Works Frank Clark.

After a three-year period of remaining at home, Mrs. Hines resumed work during the legislative session of 1947, as secretary to Harold P. Norton, special representative of the Department of Public Works. In October of the same year she transferred to Central Office Administration, working for George Cook, then assistant secretary of the California Highway Commission; and in turn served five secretaries of the commission.

Mrs. Hines, who is also active in the Order of Eastern Star, resigned for a 16-month period from 1952 to 1954 to serve as Worthy Matron of Rainbow Chapter No. 385. She was appointed Grand Esther of the State of California for the year 1961, traveling to various parts of California during weekends and vacation.

She is also affiliated with Menzaleh Temple No. 16, Daughters of the Nile, and presently serves as marshal of the organization. Golf is a favorite recreation.

Mrs. Hines is a native Californian, born in Petaluma. She attended high school, Sacramento Junior College, and Standard School for Private Secretaries in Sacramento.

Her husband, Walter, is a car shop supervisor employed by the Southern Pacific Company. The Hineses plan a Hawaiian vacation for next year.

IN MEMORIAM

District 1

Bruce A. Anderson, engineering student trainee, range B; Roy D. Johnson, assistant highway engineer; John T. Prior, engineering student trainee, range B.

District 3

Charles H. Chappelle, highway engineering associate; Michael Prychodnik, highway maintenance man II.

District 4

Walter K. French, highway maintenance man II.

District 6

Robert S. Percival, supervising highway engineer.

District 7

John H. Castaneda, highway landscape maintenance man; Leroy G. Exum, highway engineering technician I.

District 8

Stanley D. Walker, engineering aid II.

District 9

Albert C. Squires, highway foreman.

District 10

James C. Casados, junior clerk.

Headquarters Office

Merle E. Davis, senior account clerk.

Bridge Agreements Chief Has Retired

Frank Wilbur Robison, head of the Agreements Section of the Bridge Department, State Division of Highways, retired August 31.

Robison was in charge of the negotiation of maintenance and construction agreements with railroads in connection with the building of grade crossings and separations.

Robison joined the Division of Highways in 1928. He left state service in the early 1930's to complete his studies at the University of California at Berkeley and get his engineering degree. From 1934 to 1936 he was employed as an engineer on the construction of the San Francisco-Oakland Bay Bridge, after which he resumed his service with the Division of Highways' Bridge Department as assistant resident and resident engineer on bridge projects both in northern and southern California.

F. WILBUR ROBISON

In 1939 he transferred to the headquarters office of the Bridge Department in Sacramento where he held various assignments in quantity calculations, specification writing, bridge design, preliminary investigation and reports and finally as chief of the Agreements Sections.

Robison was born near Viola, Shasta County, and attended grade and high schools in Esparto and Santa Cruz.

He is a member of the American Society of Civil Engineers, Sacramento Commandery No. 2, Knights Templar and Sacramento Chapter No. 3, Royal Arch Masons.

Robison and his wife, Virginia, have a son, David Wilbur, now stationed with the U.S. armed forces in the Far East.

THIRD RIGHT-OF-WAY ACADEMY HELD AT UC DAVIS CAMPUS

ome 90 of the Division of Highway's junior right-of-way agents and some of its newer assistant agents from the state's 11 highway districts attended concentrated 88-hour course of technical training in property acquisition and related fields. Course was conducted August 2–14 at the University of California Davis campus.

Frank A. Sutcliffe Retired September 1

Frank A. Sutcliffe, Highway Superintendent in District 5, retired on September 1 after 39 years with the State Division of Highways.

Sutcliffe was superintendent at Buellton for 8 years and Paso Robles for 14.

A native San Franciscan, he attended schools in the Sacramento area and first went to work for the California Highway Commission as a chainman in 1923. After several years away from state service he rejoined the Division of Highways in 1931 and was promoted to foreman in 1935. He became a superintendent in 1943.

Sutcliffe is a charter member of the California State Employees' Association and charter president of Chapter 98. He later served as regional director for Region X. He is a Past Grand of the Odd Fellows and Rebekahs.

Sutcliffe and his wife, Emily, have two sons and a daughter and 11 grandchildren.

Right-of-Way Agent Fred Moore Retires

Fred C. Moore retired as the district right-of-way agent in District 5 on June 30.

Moore began his professional career as a mining engineer for Nevada Consolidated Copper Company in Ray, Arizona, in 1928. From 1931 to 1934 he was engineer and assayer for the Easyz Bird Mine at Mokelumne Hill, California. He then spent a year as superintendent of the Boston Gold Mines at Mokelumne Hill.

FRED C. MOORE

Moore began employment with the State Division of Highways in 1936 as a junior highway engineer in District 10. He transferred to the Right-of-way Department in District 10 as an assistant right-of-way agent in 1944, and to District 5 in 1948 to take charge of the Right-of-way Department as district right-of-way agent. He was later promoted to supervising right-of-way agent.

Moore and his wife, Leta, have two daughters: Blanche, of Stockton, and Elizabeth, of Fort Wayne, Indiana. He is a member of the American Right-of-way Association, Society of Real Estate Appraisers, an Associate of the School of Mineral Sciences of Stanford University, a Scottish Rite Mason, and a member of the Commonwealth Club.

Shop 2's Wilkinson Saves Drowning Boy

The fast action of Roy Wilkinson, heavy equipment mechanic with Shop 2, Division of Highways, in Redding saved a young boy from drowning in Lakewood Manor Lagoon.

On the morning of July 4, Wilkinson was eating breakfast in his home when another young boy came to the door and said, "There's a boy in the lake and he's drowning."

Wilkinson, an ex-Marine, dashed from his house and down to the boat dock. Thinking he saw what might be a red shirt deep in the water he plunged in and reached the bottom of the lagoon which is 15 feet at this point. As he started up again he found the boy and brought him up to the surface.

Wilkinson applied artificial respiration and after a few minutes the boy revived.

The nine-year-old boy, Kenneth Hightower, a nonswimmer, had been carrying his fishing gear when he tripped over a boat eye and fell into the lagoon.

The State Department of Public Works has awarded a $3,469,000 contract for constructing 1½ miles of eight-lane Interstate 5 Freeway between the San Diego River and three-quarters of a mile north of Tercolate Creek in San Diego County.

Scenic Highways Committee Meets With Governor

The Governor's Advisory Committee on a Master Plan for Scenic Highways met on September 21 in Sacramento.

Items on the agenda included a status report pertaining to the committee's plans for a guide to assist in designating official scenic corridors and a report on legislation affecting the scenic highway system. Also acted upon was a draft of a report to the California Legislature.

Relationship of scenic highways to the general federal and state highway programs was also examined.

Standing about Governor Edmund G. Brown are (left to right) State Director of Public Works John Erreca and committee members Dee W. McKenzie, chief of the highways and bridges division of Sacramento County Department of Public Works; Charles Perry Walker, City Councilman and former Mayor of Manhattan Beach; Richard Leonard, San Francisco attorney and conservationist; Robert Grunwald of Hanford, city and regional planning consultant; Nathaniel Owings of Big Sur, noted architect; Harry P. Schmidt of Gustine, Merced County Supervisor and committee chairman; and Edwin S. Moore, San Francisco, executive vice president of the California State Automobile Association.

ANNUAL SAFETY ENGINEERS MEETING HELD IN SACRAMENTO

The annual Safety Engineers Conference was conducted in Sacramento during August. Those who attended from the districts had a busy week for in addition to their usual sessions, they spent two days at the Materials Laboratory becoming familiar with protective measures required by the field use of radioisotopes, and the informal farewell party that marked Division Safety Engineer Baynard Switzer's (seated, fifth from right) last day in the office prior to retirement.

DISTRICT 1 OPENS NEW OFFICE BUILDING WING IN EUREKA

Coinciding with observance of National Highway Week, District Engineer Sam Helwer invited the general public to an informal open house to look over the recently completed wing of the district office building at 1656 Union Street in Eureka. District employees were on hand in the lobby to guide groups through the building and answer questions about Division of Highways operations.

TIOGA CLOSED FOR BRIDGE CONNECTION

State Highway 120 was completely closed to traffic at historic Tioga Pass from September 13 (Monday) through September 17 (Friday) while workmen removed a temporary bridge being used during construction and made connections to the permanent bridge which had been constructed beneath it.

Closure dates were selected, says California Division of Highways District 9 Engineer C. A. Shervington, because they caused the least inconvenience to Labor Day weekend vacationers and to summer tourists.

Modifications and improvements at Tioga Pass were started three years ago. The lengthy construction period was necessary because annual heavy snowfalls at the 9,500-foot level permit crews to work only a few months each summer.

Although a lofty climb under the best conditions, Route 120 between US 395 near Lee Vining and the eastern edge of Yosemite National Park is becoming increasingly popular with California drivers.

In July, 30,000 vehicles traveled over it although it had to be closed temporarily for several hours on weekdays when blasting operations were required to remove rock from the sheer cliffs.

Much of the work was done on weeknights when traffic on the road was at a minimum.

Department Awards Two Large Contracts

The State Department of Public Works has announced the award of a $1,628,000 contract for construction of an interchange at Avenue 12 and a separation at Avenue 13 on US 99 between the Fresno county line and Madera.

The contract is the final phases of converting this section of US 99 from expressway to full freeway.

The department also announced award of a $1,487,000 contract for constructing a bridge and approaches across the Klamath River on Route 96 just south of Orleans in Humboldt County.

The original bridge was washed out during the recent Christmas floods.

STATE OF CALIFORNIA

EDMUND G. BROWN, *Governor*

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DEPARTMENT OF PUBLIC WORKS . . . JOHN ERRECA, Director

FRANK A. CHAMBERS . . . . Chief Deputy Director

RUSSELL J. COONEY . . Deputy Director (Management)
HARRY D. FREEMAN . . Deputy Director (Planning)
T. F. BAGSHAW . . . . . Assistant Director
C. RAY VARLEY . . . . . Assistant Director
JUSTIN DuCRAY . Departmental Management Analyst
S. ALAN WHITE . . Departmental Personnel Officer

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J. P. MURPHY . . . Deputy State Highway Engineer
J. A. LEGARRA . . Deputy State Highway Engineer
GEO. LANGSNER . . Deputy State Highway Engineer
LYMAN R. GILLIS . Assistant State Highway Engineer
J. E. McMAHON . . Assistant State Highway Engineer
FRANK E. BAXTER . Assistant State Highway Engineer
GEORGE A. HILL . Assistant State Highway Engineer
J. C. BURRILL . . . . . Comptroller
NEAL E. ANDERSEN . . . . . Equipment Engineer
JOHN L. BEATON . . Materials and Research Engineer
C. G. BEER . . . . . Urban Planner
A. N. DUNHAM . . . Computer Systems Engineer
ALVORD C. ESTEP . . . . . Engineer of Design
J. F. JORGENSEN . . . . . Construction Engineer
SCOTT H. LATHROP . Personnel and Public Information
C. T. LEDDEN . . City and County Projects Engineer
JACK E. PEDDY . . . . Project Control Engineer
DANA G. PENGILLY . . . . . Planning Engineer
E. J. L. PETERSON . . Program and Budget Engineer
R. V. POTTER . . . . Systems Research Engineer
PAUL C. SHERIDAN . . . . . Office Engineer
E. L. TINNEY . . . . . Maintenance Engineer
DONALD P. VAN RIPER . Principal Landscape Architect
J. E. WILSON . . . . . Traffic Engineer
A. L. ELLIOTT . . . . Bridge Engineer—Planning
H. R. HINEMAN . . . Bridge Engineer—Operations
R. J. IVY . . . Bridge Engineer—Administration
DALE DOWNING . . Bridge Engineer—Southern Area

Right of Way

RUDOLF HESS . . . . . Chief Right of Way Agent
HARRY L. KAGAN . . . . . Assistant Chief
DEXTER D. MacBRIDE . . . . . Assistant Chief
R. S. J. PIANEZZI . . . . . Assistant Chief

District 1, Eureka

SAM HELWER . . . . . District Engineer

District 2, Redding

H. S. MILES . . . . . District Engineer

District 3, Marysville

W. L. WARREN . . . . . District Engineer

District 4, San Francisco

ALAN S. HART . . . . . District Engineer
R. A. HAYLER . . . . . Deputy District Engineer
HAIG AYANIAN . . . . . Deputy District Engineer
C. F. GREENE . . . . . Deputy District Engineer

District 5, San Luis Obispo

R. J. DATEL . . . . . District Engineer

District 6, Fresno

W. L. WELCH . . . . . District Engineer

District 7, Los Angeles

E. T. TELFORD . . . . . District Engineer
A. L. HIMELHOCH . . . . Deputy District Engineer
A. C. BIRNIE . . . . . Deputy District Engineer
A. W. HOY . . . . . Deputy District Engineer
R. E. DEFFEBACH . . . . Deputy District Engineer

CALIFORNIA HIGHWAY COMMISSION

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ROGER S. WOOLLEY . . Vice Chairman San Diego
JAMES A. GUTHRIE . . San Bernardino
ABRAHAM KOFMAN . . . Alameda
FRANKLIN S. PAYNE . . Los Angeles
WILLIAM S. WHITEHURST . . . Fresno
JOSEPH C. HOUGHTELING . . Sunnyvale

JOHN ERRECA . Administrative Officer and Director of Public Works
JACK COOPER, Secretary . . . Sacramento

District 8, San Bernardino

C. V. KANE . . . . . District Engineer

District 9, Bishop

C. A. SHERVINGTON . . . . . District Engineer

District 10, Stockton

JOHN G. MEYER . . . . . District Engineer

District 11, San Diego

JACOB DEKEMA . . . . . District Engineer

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EMERSON RHYNER . . . Deputy Chief (Sacramento)
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REGINALD B. PEGRAM Deputy Chief (Los Angeles)

DIVISION OF BAY TOLL CROSSINGS

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J. J. KOZAK . . . . . Deputy Chief Engineer
BEN BALALA . . . Design and Construction Engineer
CHARLES L. SWEET . . . . . Operations Engineer
HOWARD F. TOPPING . . . . Planning Engineer
GEORGE F. ANDERSON . . . Administrative Officer

DIVISION OF AERONAUTICS

CLYDE P. BARNETT . . . . . Director, Chief of Division

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NATIONAL HIGHWAY WEEK OBSERVED THROUGHOUT CALIFORNIA

National Highway Week was observed throughout California during the week, September 19-25, 1965. More communities took part than in any past year with much of the impetus coming from local chambers of commerce.

The National Highway Week Committee for California was headed by cochairmen Harrison Baker of Los Angeles who served in the south and Sherman Duckel of San Francisco who performed like duties in the north. Administrative secretary was Richard Bowler of the Auto Club of Southern California. Publicity secretary was Dick Pollard of Californians for Modern Highways.

Activities included the usual dedications and ground-breaking ceremonies associated with recently completed or about-to-begin freeway construction. Not so usual was the planting of a single redbud shrub at Mariposa where the Highway 140 Association chose National Highway Week as the proper time to plant the first of 20,000 redbud shrubs that will one day transform Route 140 into the "Redbud Highway."

Also unique was the activity conducted by the City of Sunnyvale and the Sunnyvale Chamber of Commerce. The fact that there was no construction project about to begin or end in their locale did not deter them—they simply went on a tour of going projects, held proper ceremonies in the city hall and sponsored a luncheon.

Another tour, slightly different in nature, took place in Sacramento where the press inspected all highway construction in the vicinity of the city.

As a prelude to the week, Californians for Modern Highways sponsored an exhibit at the California State Fair in Sacramento that was dedicated to the state highway system.

In Los Angeles County, District 7, 8 and 11 joined with Californians for Modern Highways in operating an exhibit at the county fair in Pomona. The focal point was the showing of two movies. The first was Walt Disney's "Freeway Phobia" that Disney permitted to be shown in advance of its regular commercial release date. The second was "Christmas Floods—1964," a vivid film account of the subject.

Other visual exhibits were popular throughout the state but the San Francisco Bay area probably led in their use with nine on display in a like number of locations.

Radio and television stations were most cooperative with many donating public service time for announcements pertaining to National Highway Week. Approximately 20 television shows pertaining to the occasion were aired in various parts of California. They ranged in scope from panel discussions of local problems to film coverage of the restoration of Humboldt County's highways that were damaged in last year's floods.

Newspapers were equally generous and were probably unanimous in printing news stories of observances that took place in their communities. Newspapers published by labor unions were especially receptive to news of National Highway Week.

Only a few of the events that took place during the week are mentioned here. There were many others of equal or greater importance, that occurred in other communities.

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ANNUAL REPORT ISSUE

november-december 196

Letters of Transmittal

December 13, 1965

MR. JOHN ERRECA
Director of Public Works
State of California

Dear Sir:

In compliance with Section 143 of the Streets and Highways Code, the 19th Annual Report of the Division of Highways for the fiscal year ending June 30, 1965, is submitted herewith for your approval and transmittal to Governor Edmund G. Brown.

The report also includes the highlights of the division's construction through calendar year 1965, as well as a description of the projects in the 1966–67 fiscal year budget, adopted by the Highway Commission at its October meeting.

As in the past several years, construction emphasis has been on the completion of California's portion of the national system of defense and interstate highways, a system within and comprising about 17 percent of this state's 12,497-mile freeway and expressway system.

I am pleased to report that 66 percent of these interstate freeways, which by 1975 will carry 30 billion of an expected 141 billion motor vehicle miles of travel in California, has been completed, or is under construction or budgeted.

Simultaneously, the division has made good progress in converting conventional highways to freeway standards, and in enhancing safety and mobility on other routes in every area of the state by engineering improvements.

The text portion of the annual report is illustrated and published as the November–December issue of our bimonthly magazine, *California Highways and Public Works*. A supplement containing financial statements, apportionment tables, contract statistics and other data will be available to interested persons on request.

J. C. WOMACK
State Highway Engineer

December 14, 1965

EDMUND G. BROWN
Governor of California

My dear Governor:

It is my pleasure to submit to you the 19th Annual Report of the Division of Highways, Department of Public Works, which presents the activities of the division's various units in the past fiscal year, and describes our progress in planning and constructing today for our future transportation needs.

California began 1965 while reeling under the blows of last winter's devastating floods. However, through the combination of the skill and determination of the Division of Highways personnel with legislation that provided emergency flood damage repair funds, our highways and bridges were replaced or repaired in record time. Our overall construction schedule was not delayed.

In addition to the progress on the interstate system freeways, that the State Highway Engineer reported in the attached letter, California made steady gains in 1965 toward the completion of its 12,497-mile freeway and expressway system, master-planned by the Legislature.

This year, of the estimated 47 billion motor vehicle miles traveled on state highways, approximately half took place on freeways. This not only represents a decrease in the traveled miles on formerly high volume conventional highways, but a great gain in terms of the saving of human lives and suffering.

In a report prepared in October in cooperation with the U.S. Bureau of Public Roads, the Traffic Department of the Division of Highways stated, "If the amount of freeway travel that occurred in 1964 on California's state highway system had been forced to occur on conventional highways and expressways, there would have been approximately 78,500 additional accidents and over 650 additional fatalities."

Knowing that the conversion of routes to full freeway standards where traffic conditions warrant is the single greatest advance we can make in the cause of traffic safety, we are confident that the more than 200 miles of freeway opened to traffic in 1965 will result in additional prevention of highway carnage.

We are not only building safer traffic facilities, but we are paying increasing attention to making them more attractive. This has resulted in additional emphasis on design aesthetics and in stepped-up programs for landscaping and driver amenities.

Respectfully,

JOHN ERRECA
Director of Public Works

California Highways and Public Works

Official Journal of the Division of Highways, Department of Public Works, State of California

VOL. 44 November–December Nos. 11–12

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Address communications to: EDITOR,

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P.O. Box 1499

SACRAMENTO, CALIFORNIA 95807

FRONT COVER: The men raking leaves on the front cover are Robert Johnson and R. D. Collins, both of District 11 Maintenance Department. The leaves are in the median of the US 395 freeway through Balboa Park, just a few blocks from the heart of downtown San Diego. In this year of great emphasis on highway beautification, the California Division of Highways can proudly point to this urban freeway, and dozens of other such landscaped freeways throughout the state, as proof California has long been a leader in highway beautification. Photograph by Bill Ruland.

BACK COVER: The replacement of the old sidehill viaduct at Dodge Point near the summit of Tioga Pass on State Route 120 will make passage of this route safer and easier for motorists. The new structure is part of the modernization program on the eastern end of this route. A comprehensive article on Tioga Pass will appear in the next issue of this magazine. Photograph by Bill Ruland.

This photo of the California Highway Commission was taken at its April meeting in Sacramento. Seated clockwise around the table are (left): Robert B. Bradford, Administrator of the Transportation Agency and Chairman; John Erreca, Director of Public Works and Administrative Officer; Roger S. Woolley; Franklin S. Poyne; Joseph C. Houghteling; Jack Cooper, Commission Secretary; Robert T. Martin, Assistant Secretary; J. C. Womack, State Highway Engineer; William S. Whitehurst, Abraham Kolmon, and James Guthrie.

CALENDAR OF MEETINGS

CALIFORNIA HIGHWAY COMMISSION
JULY 1, 1964, TO JUNE 30, 1965

July 9, 1964 ..... Los Angeles
Public hearing, 07-LA-118, between 0.3 mile west of DeSoto Avenue and the adopted Route 210 Freeway near Hansen Dam

July 29, 30 ..... Sacramento

July 31 ..... Woodside
Public hearing, 04-SM,SCl-24, between Route 35 (Skyline Boulevard) and Santa Cruz Avenue in Menlo Park

August 31 ..... Sacramento

September 1 ..... Sacramento

September 10 ..... Pasadena
Public hearing, 7-LA-2,7,210, Route 2, between Verdugo Boulevard and Foothill Boulevard; Route 210, between Wheatland Avenue and Linda Vista Avenue; Route 7, between Huntington Drive and Route 134; Route 210, between Linda Vista Avenue and 0.3 mile east of junction of Route 134

September 23 ..... San Diego

October 22, 23 ..... Echo Summit
Inspection of state highways in El Dorado, Alpine and Calaveras Counties

October 28, 29 ..... Sacramento

November 18 ..... Sacramento

December 16 ..... Sacramento

January 8, 1965—Business meeting ..... Los Angeles
Public hearing, 7-Ven-118, between First Street and Patterson Ranch Railroad spur near Tapo Street

January 26
Inspection of flood-damaged state highways in Mendocino, Humboldt and Del Norte Counties

January 27 ..... Sacramento

February 24, 25 ..... Los Angeles
Inspection of state highways in Riverside and San Bernardino Counties

March 24 ..... Sacramento

March 25 ..... Los Banos
Public hearing, 10-Mer-152, between junction of existing Route 207 and the Madera county line

April 28, 29 ..... Sacramento

May 25 ..... Long Beach
Public hearing, 7-LA-1,22, Route 1, between Pacific Coast Highway at Colorado Street and Vermont Avenue; Route 22, between Pacific Coast Highway at Colorado Street and Cerrito Channel

May 26 ..... Los Angeles

June 17 ..... San Bruno

June 29, 30 ..... Sacramento

The list of past members of the California Highway Commission which has appeared yearly in the annual report will now be published every fourth year.

Copies of the organization charts of the Department of Public Works and the Division of Highways which formerly were included in the report are now available upon request.

California Highways... 1965

Building a freeway is a complex task that requires the services of skilled workers. On the average, for every $1,000,000 spent on highway construction, $325,000 goes to pay the salaries of individuals such as these two men who were photographed during May as they did cement work on Routes 82 and 87 in San Francisco.

The repair and renovation of highways and bridges in northern California that were either damaged or swept away by last winter's floods was of primary concern during 1965.

Because state highways are the economic lifelines on which the citizens of the ravaged area must depend, there was no wasted motion in the campaign to reopen them. The engrossing story of the way in which this was done and the cost in time, manpower, materials and cash required to accomplish the task have been reported in previous 1965 issues of *California Highways and Public Works*.[1]

But there was not complete preoccupation with bringing the northland back to normal. In addition to the routine tasks, increasing emphasis and greater centralized control of other programs that have been in effect for a number of years took place. Of the latter, the two most significant and of great obvious interest to the public were highway beautification and traffic safety.

The Division of Highways philosophy regarding highway beautification was embodied in a document that originated from within the California Highway Commission. In the form of a resolution, and passed unanimously by the commissioners, it called for practical cooperation from the commission, the Department of Public Works and the division with various federal agencies and the California State Legislature in implementing the Federal Highway Beautification Program.

The commission lauded the effective programs of identical or allied nature that the division has been pursuing toward ultimate completion for the past several years.

Scenic System Included

Included is the 5,000-mile scenic highway system. Its general standards and criteria were adopted by Governor Edmund G. Brown's Advisory Committee on a Master Plan for Scenic Highways.

A complimentary program is the construction of roadside rests at 257 locations scattered throughout California. A number of them have been completed and the total open to the public increases on an almost month-to-month basis.[2]

The commission drew attention to the $45 million already spent on installing landscaping along state highways and the additional like sum spent in the maintenance of existing landscaped areas.

In the budget for the coming fiscal year, the commission boosted that previous $90-million total to well over the $100-million level by earmarking approximately $17 million more for new

[1] January–February 1965, *California Highways and Public Works*.

[2] July–August 1965, *California Highways and Public Works*.

landscaping and maintenance during the 1966–67 fiscal year.[3]

The commission also pledged support to the accelerated interest in highway beautification that is sweeping the state and the nation and charged the division with making the public aware of both its interest and its policy.

Similar pride, concern and interest were evidenced by Governor Brown in October when he announced the contract award of the largest highway landscaping job in the division's history at a press conference.

The contract calls for the beautification of a 5.8-mile stretch of the San Diego Freeway between Long Beach and Signal Hill. Among the requirements are the planting of more than 18,000 shrubs, approximately 4,000 trees and almost a million and a half ground cover plants.

STATUS OF CALIFORNIA'S 43 SAFETY ROADSIDE RESTS

County	Location	Status
Amador	Route 88, 4 miles west of Jackson	Open, but no water supply
Calaveras	Route 49, 4 miles south of Angels Camp	Open, but no water supply
Calaveras	Route 49, 7 miles south of San Andreas	Open, but no water supply
Del Norte	US 199, at south portal Collier Tunnel, 3 miles south of Oregon border	Open
Glenn	Interstate 5, pair; about 2 miles south of Artois	Under construction
Imperial	Interstate 8, 20 miles west of Arizona border	Open; comfort facilities to be added
Inyo	US 395, near Haiwee Reservoir	Open
Inyo	US 395, near Division Creek north of Independence	Budgeted
Kern	Interstate 5, near Lebec	Open, but no comfort facilities
Lassen	Route 44, 28 miles northwest of Susanville	Budgeted
Lassen	US 395, 12 miles south of Ravendale	Open
Los Angeles	Interstate 5, near Castaic	Map inspection station; under construction
Mariposa	Route 140, 8 miles east of Mariposa	Open, but no water supply
Merced	Interstate 5, pair; near San Luis Dam near Los Banos	Under construction
Nevada	Interstate 80, pair; near Donner Summit	Open
Plumas	Route 70, 46 miles east of Quincy	Open, but no water supply
Riverside	Interstate 10, pair; 15 miles east of Indio	Open, with comfort facilities to be added later
San Bernardino and Riverside	Interstate 10, pair; between Redlands and Beaumont	Open; comfort facilities under construction
San Bernardino	Interstate 10, near Fontana	Map inspection station; under construction
San Bernardino	Interstate 15, 3 pairs; all east of Barstow	All open; two pair with comfort facilities, which will be provided later for the third pair
San Bernardino	Interstate 40, three rests; between Needles and Barstow	Open, but no water supply
San Diego	Interstate 5, near Leucadia	Map inspection station; under construction; no restrooms
Shasta	Route 299, 38 miles east of Redding	Open, but no water supply
Tehama	Interstate 5, pair; north of Red Bluff	Open
Trinity	Route 299, 5 miles south of Weaverville	Open
Tulare	US 99, pair; 5 miles north of Tipton	Open

Work Started

Actual work started during November by Valley Crest Landscape, Inc., of Van Nuys. The amount of their contract was in excess of $429,000.

On July 30, State Highway Engineer J. C. Womack announced changes in the financing of the long-established "spot correction" program. ("Spot correction" is simply the identification and correction of any point in the highway system that has caused an accident concentration.)[4]

In the past, individual projects were financed from available contingency funds but on Womack's recommendation, the commission established a $3-million budget item as the prime source of funds for these traffic engineering safety improvements. Because counties and cities often are involved in the projects, it is anticipated that another $1,500,000 will be provided by those local governments.

Traffic engineering safety improvements include easing curves, installing or modifying signals, constructing left-turn storage lanes, applying antiskid treatment to the road surface, providing truck climbing lanes, and many more. Some of these will also serve to reduce congestion and delay to the motorist.

Womack said that more costly and extensive projects for accident reduction, such as replacing narrow bridges, installing median barriers on freeways, and correcting curves in rugged terrain, will continue to be financed by the general state highway construction budget, and sometimes in part by federal moneys, rather than by the special fund.

Statistics are not yet available for 1965, but in 1964 there were 32 accident reduction projects costing more

[3] 1966–67 highway budget, this issue.
[4] July–August 1965, *California Highways and Public Works*.

an $50,000 each included in the 1 safety improvement projects com-eted. They brought the total cost of ch projects to nearly $8,200,000 for at year. This total includes more than 50,000 in projects costing less than ,000 each.

Fewer Accidents

The State Highway Engineer esti-ated that 800 to 1,000 fewer accidents ch year will occur at these 301 im-oved locations. These safety benefits e in addition to the large number of cidents that will be prevented by utine improvements carried out by e division's maintenance crews on a y-to-day basis. These include install-g warning signs, striping, and the de-ieation of curves and fixed objects.

Going back even further, a study 1962 of former problem locations iproved by projects in the $5,000–0,000 range reflected about a one-ird reduction in accidents. A recent view of the benefits to be expected dicates a 25-percent reduction in ac-dents, probably because many of the orst locations have been corrected, Womack added.

While the California "spot correc-on" program is in line with the epped-up nationwide emphasis on affic safety projects announced re-ntly by Federal Highway Adminis-ator Rex M. Whitton, Womack ex-ained that federal aid funds are not nanneled into these projects in this ate.

Instead, the federal aid moneys are pplied to construction of the ma-r freeway projects, which, Womack ointed out, provide maximum bene-ts in term of safety as well as effi-ency and economy. Freeways now operation in California are credited ith saving one life and preventing 65 juries every day, as compared with hat the records show would have ppened if the same amount of travel id taken place on conventional roads.

He emphasized that the continual rveillance of the highway system to cate accident concentration locations is been a long-established procedure, ut has received increased attention in cent years. This has been aided by ie use of electronic data processing ethods to pinpoint trouble spots.

How high were the waters over US 101 in Humboldt County during last winter's floods? The signpost shown on the left side of the above photograph is accurate. The water actually covered the road and adjacent lands to the level of the horizontal striped bar.

One of the most important and spectacular freeway openings during the year was the new section of Interstate 80 over the Donner Pass area. This photo, taken from above the summit, is looking eastward across Donner Lake.

Dangerous Locations Reported

Other dangerous locations are reported by enforcement officers, public agencies and individual citizens.

"Equally important as finding hazardous spots," Womack said, "is determining if and how they can be neutralized.

"Too many people see cure-alls in recommending such things as traffic signals, for example, where possibly these would increase the number of accidents. There are more rear-end accidents at signalized intersections, although these are usually less severe than the broadside accidents the signals reduce."

The $3,000,000 special fund will be divided among the 11 state highway districts according to their amount of travel and accident percentages.

The concept of using airspace over and under freeways for other productive purposes by public agencies and for private use has been under study for the past five years.[5]

[5] September–October 1965, *California Highways and Public Works.*

In July, a meeting of state, county and city officials was called by Robert B. Bradford, Administrator of the State Transportation Agency, to discuss the matter.

He opened the meeting by outlining the state's philosophy in the following words.

"California is gaining 1,750 people a day. By 1980, we are convinced that resulting land shortage will force building over and under freeways.

"This will happen even if we do no long-range planning. What we must do now is see that this building is designed purposefully rather than through neglect of the highest and best use—a use in keeping with local community plans."

Team Effort Needed

He emphasized that this can be accomplished only by the team efforts of the state, cities and counties, and that all such construction must be approved by local government.

"We are not talking about any total use of this airspace," Bradford added. "but selective development of property sensitively done in selected areas."

The California Highway Commission will not be interested solely in high bids in leasing airspace but will insist that proposals benefit the community, he promised.

Delegates from all cities and counties represented agreed that full consideration must be given to aesthetics and that no use of space over and under freeways be authorized where landscaping is more appropriate. Unanimous concern for motorists was expressed and warnings voiced to disregard any temptation to approve construction that might result in disservice to drivers by routing traffic through a series of boxlike tunnels.

The Legislature established the California Highway Commission in its present form in 1943 to insure not only continuity of highway policy, but also its removal from sectional or political considerations.

Its membership comprises six business and professional men, appointed by the Governor and confirmed by the Senate, plus as its chairman, the Administrator of the Transportation Agency. The State Director of Public Works serves as its administrative officer.

The six members serve without pay for four-year staggered terms. They are required by law to represent the entire state rather than a particular area.

Commission Duties

The commission's duties include the budgeting and allocating of state highway funds, the determining of routings for freeways and other highways, and the approval of select systems of county roads and city streets, the authorizing of condemnation proceedings, and approving the terms and conditions of deeds and right-of-way relinquishments and abandonments.

The commission adopts an annual budget each October for the coming fiscal year. For fiscal year 1966–67, it budgeted $651,919,655 for state highway construction purposes, including rights-of-way and engineering. However, to insure that all savings from individual projects can be made available quickly for other work, it adjusts budgeted amounts at its regular monthly meetings.

The Division of Highways, a unit of the Department of Public Works, is

An on-the-spot inspection by Governor Edmund G. Brown of new MacArthur Freeway construction in Oakland took place in October. He was accompanied by (left) Alan Hart, district engineer, and (right) Gordon Ball, the cantractor whose firm accomplished the construction. The Governor cited the fact that vehicles that travel the new stretch of approximately four freeway miles in lieu of city streets save eight minutes.

his section of Route 1 in Monterey County is o portion of the first officiol scenic highway to be odopted by the State Department of Public Works. The ntire link is between the San Luis Obispo county line and the Carmel River. To be clossified a scenic highway, a rood must traverse areas of outstanding eouty; and in locotion design ond construction receive special ottention regarding its visual appearance ond ability to blend into the surrounding landscope.

n organization of career employees hosen and promoted on the basis of ompetitive examinations. It is respon- ible for the actual operation of the ighway program including planning, esign, right-of-way acquisition, con- truction and maintenance.

Its chief, the State Highway Engi- eer, is assisted by a headquarters staff n Sacramento and by 11 highway dis- rict engineers and their staffs who are esponsible for all aspects of the high- vay program in their areas.

Experience has shown that this decentralization makes the program more responsive to local conditions and needs.

Information on local highway matters may best be obtained from the following, their areas delineated by the accompanying map:

District 1—Sam Helwer, District Engineer, 430 West Wabash Avenue, Eureka

District 2—H. S. Miles, District Engineer, 1657 Riverside Drive, Redding

District 3—W. L. Warren, District Engineer, 703 B Street, Marysville

District 4—Alan S. Hart, District Engineer, 150 Oak Street, San Francisco

District 5—R. J. Datel, District Engineer, 50 Higuera Street, San Luis Obispo

District 6—W. L. Welch, District Engineer, 1352 West Olive Avenue, Fresno

District 7—E. T. Telford, District Engineer, 120 South Spring Street, Los Angeles

District 8—C. V. Kane, District Engineer, 247 Third Street, San Bernardino

District 9—C. A. Shervington, District Engineer, South Main Street, Bishop

District 10—J. G. Meyer, District Engineer, 1976 East Charter Way, Stockton

District 11—J. Dekema, District Engineer, 4075 Taylor Street, San Diego

California subscribes to the philosophy that pay-as-you-go is the best way to plan, construct and maintain highways. But that theory could have been put to the acid test early in the year when it became obvious that $50–$60 million would be required to finance the immediate program envisioned for restoring flood-damaged roads and bridges.

Instead, however, the funds were derived from a special 1-cent-a-gallon gasoline tax that went into effect on April 1 and was rescinded on August 31. The tax was imposed by Senate Bill 268, which was introduced by Senator Randolph Collier, Chairman of the Senate Transportation Committee. It could have remained in force for a maximum of nine months but was lifted at the end of August by Governor Brown because of excellent progress made in the repair program and the availability of enough additional funds from federal and other sources to ensure completion.

Revenue Sources

With the exception of this very temporary tax, funds were derived from such fairly predictable sources of revenue as gasoline and diesel fuel, drivers' licenses and registration fees, weight fees on commercial vehicles, and taxes on for-hire trucking.

California's Constitution requires that revenues from highway-user taxes be used for road construction and maintenance, and the administration of the Division of Highways, the Department of Motor Vehicles and the Highway Patrol.

Federal moneys stemming from the U.S. government's taxes on the highway user are returned to the state according to complicated formulae. More than 91 percent of the cost of constructing the state's portion of the interstate system is recompensed from federal funds, as is 58 percent of the amount spent on certain federal aid primary, secondary, and urban highway projects.

The Highway Commission is required by law to allocate 55 percent of construction funds to the 13 southern counties and 45 percent to the remaining 45 counties each year. The law further requires certain minimum expenditures in each highway district, including a minimum of $4,000,000 in each county over each four-year period, except in sparsely populated Alpine and Sierra Counties, where this minimum is $1,000,000.

The Legislature, not the Highway Commission, designates routes as state highways, both freeway and conventional, and fixes their general termini. It sometimes specifies certain general

	Miles Completed and in operation Dec. 31		*Miles under construction or budgeted Dec. 31*	
	1964	*1965*	*1964*	*1965*
Full freeway	1,570	1,825	758	735
Multilane divided expressway	740	704	58	53
Subtotal	2,310	2,529	816	788
Two-lane expressway	777	823	129	111
Conventional highway	11,113	10,848	69	82
Total, state highway system	14,200	14,200	1,014	981

Freeway and expressway figures include interstate.

Spring always comes late in the year to some California highways. This statement is proved in the above photograph taken in June at Carson Pass on Route 88 in Alpine County.

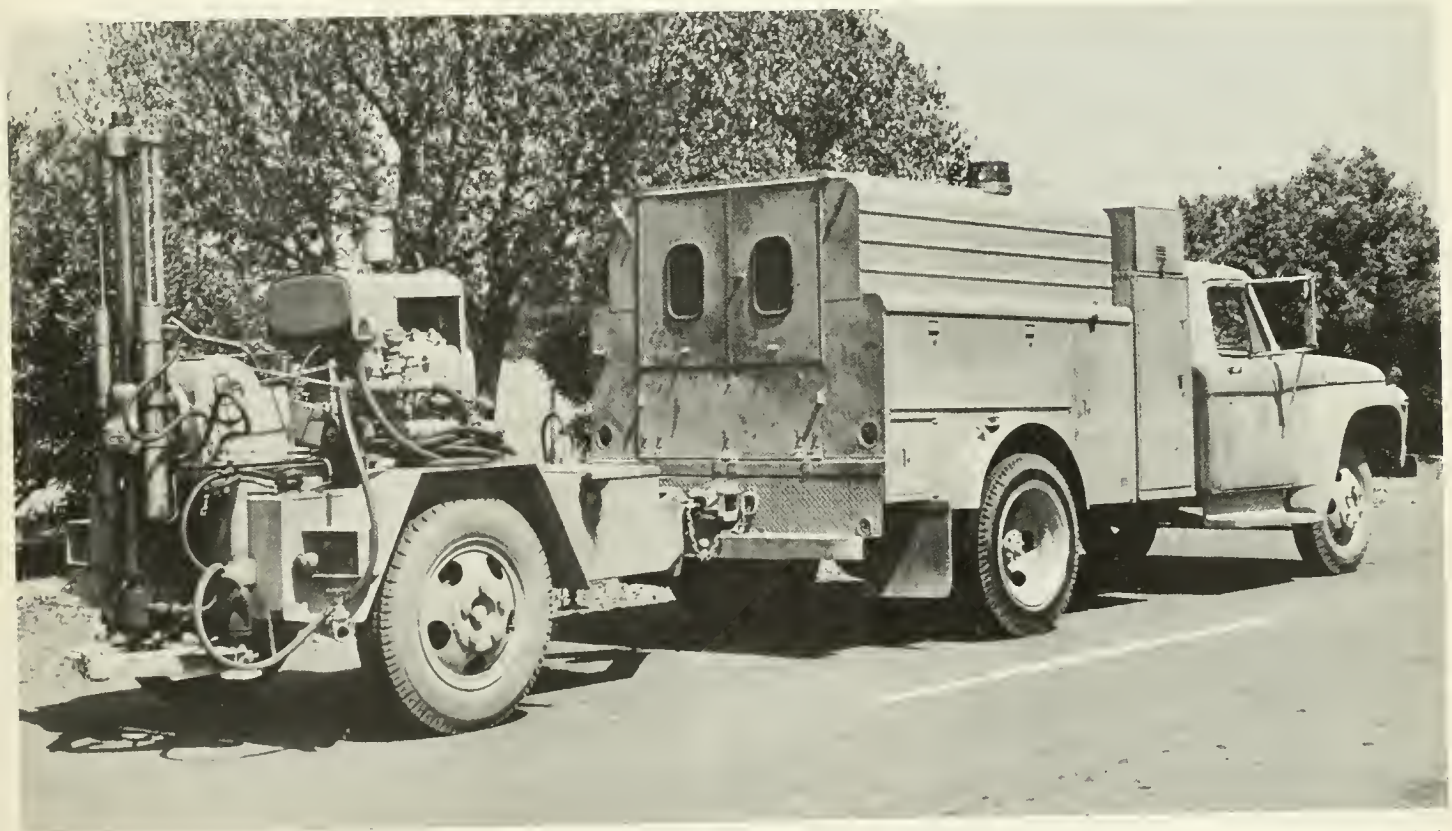
control points through which they must pass. It remains for the Highway Commission, however, to determine specific routings.

District Engineer's Duties

Like the old-time policeman on the beat, the local district highway engineer knows the area for which he is responsible. When he finds that freeway location studies are indicated, he obtains authority to make them from the State Highway Engineer.

Governing bodies of cities and counties are informed at the start of such studies. Both are asked to cooperate and to provide available information on any master plan for transportation and development of the area concerned.

The district engineer's staff develops several feasible alternates, considering the destination desires of motorists, community plans for land use, the controls imposed by terrain and other factors, the effect of each alternate on individual properties and on community values, and the relative costs for



Mobile coring machines like the one shown here are used for cutting cores up to 12 inches in diameter from finished roadways to check compliance of the as-built roadway against the specifications.

The chain link fences that form protective barriers on freeway overcrossings designed in recent years for pedestrian use have been modified from a square cagelike effect to this less confining structure. This type provides full protection and at the same time avoids any tunnel effect.

construction and right-of-way acquisition.

All concerned—interested agencies of federal, state and local governments, water and school districts, and utility and transportation companies, among others—are consulted during the development of the several alternates. All alternates under study are mapped and fully discussed at public hearings at which area residents are urged to express their views.

When the completed report of route studies is received by the State Highway Engineer, he reviews and analyzes it and recommends a routing to the Highway Commission. The commission, however, never adopts a routing without informing the local governing body of its intention to do so and asking if a public hearing by the commission itself is desired. On occasion, it will set a hearing date without such a request when it determines that a hearing would be in the public interest.

All Factors Considered

The route finally chosen is that which the commission considers will best serve the general public, taking all factors into consideration.

Cooperation continues between the state and local government following route selection. Representatives of both negotiate a freeway agreement covering local street and road adjustments necessitated by the new freeway facility.

Agents of the Right of Way Department of the Division of Highways rightly regard themselves as working both for the state and for the affected property owner.

To permit intelligent planning by those whose properties will be required by freeway construction, agents visit affected residents to explain acquisition procedures, as soon as design studies are sufficiently advanced to identify properties in the freeway's path.

Property appraisal is always based on "fair market value," defined by the courts as the "highest price in terms of money which the land (property) will bring if exposed for sale in the open market with a reasonable time to find a purchaser, buying with full knowledge of all the uses and purposes to which it is adapted and for which it is capable of being used."

In fairness to all, the appraisers consider only objective factors and are completely uninfluenced by bargaining procedures.

In acquiring rights-of-way, not only does the state pay cash but no real estate commissions or title costs and document fees are involved. Additionally, the U.S. Internal Revenue Service does not tax income or capital gains on the increase in the sale price above the original cost when properties are sold to governmental agencies for public purposes, provided that the money received is used to purchase similar properties within specified time limits. U.S. Veterans Administration and California Department of Veterans' Affairs loans may be transferred to the new properties.

NATIONAL SYSTEM OF INTERSTATE AND DEFENSE HIGHWAYS

(Total miles: 41,000—to be completed in 1972)

	Completed and in operation		*Under construction or budgeted*		*Adopted*	
	Dec. 1964	*Dec. 1965*	*Dec. 1964*	*Dec. 1965*	*Dec. 1964*	*Dec. 1965*
California allotment interstate mileage	694	817	534	620	819	610

Total miles: 2,166.

The 1965 Construction Picture

Repairs to the highways and bridges that were destroyed or damaged by last winter's floods required major construction effort in 1965. However, since they were described extensively in previous issues, they will not be repeated here.

Construction emphasis this year remained on California's 2,166-mile portion of the interstate system, which under present federal law must be completed by October 1972, while, at the same time, increasing safety and mobility in all parts of the state.

The recently adopted 1966–67 fiscal year budget again provides for split-financing of some projects which legally can be placed under contract in their entirety with the assurance that next year's budget will finance their completion. Additionally, the new budget completes financing of projects similarly split-financed last year.

San Diego and Imperial Counties

On the Interstate 5 Freeway, which when completed will extend between the Mexican and Canadian borders, a project completed in August between the south city limit of National City and 13th Street provided an eight-lane connection between the four-lane US 101 Freeway extending southward to the Mexican border, and the eight-lane I-5 Freeway extending northward to Palm Avenue in San Diego.

A viaduct was completed in August to connect the I-5 Freeway near Palm Avenue to the existing highway (US 101) near Lindbergh Field, and work progresses to extend the freeway to just south of the San Diego River.

The 1966–67 fiscal year budget provides funds for projects which will extend this eight-lane facility to an interchange under construction near Tecolote Creek and from this interchange to 0.5 mile north of Balboa Avenue in San Diego, where it will connect to a project under construction in Rose Canyon.

North of Balboa Avenue, construction is underway to near Del Mar, connecting to a project northerly to near Encinitas which was completed in April. This in turn connects to another section under construction to the previously completed freeway through Carlsbad and Oceanside to north of the San Luis Rey River.

Work is just starting on a 9.7-mile northerly extension of the completed freeway and the new budget provides funds to continue it to just north of the San Diego-Orange county line.

An Interstate 8 Freeway section was completed in June, which with a project under construction and one newly budgeted will extend this freeway from El Cajon to 2.5 miles east of Alpine.

Farther east, a budgeted project will provide six miles of freeway west of Boulevard, connecting to a 10-mile project under construction between Boulevard and the Imperial county line.

The eastbound lanes of this freeway in the rugged terrain of the Mountain Springs area east of the San Diego-Imperial county line were completed this year. The westbound lanes had been completed in 1964.

A project has just begun on I-8 between El Centro, Imperial County, and east of Route 111. The 1966–67 budget will finance construction 7.5 miles from south of Seeley to El Centro.

It also provides funds for the first unit of the eight-lane Interstate 805 Freeway in San Diego between north of Home Avenue and I-8.

The US 395 Freeway between Miramar Road at the Miramar Naval Air Station and north of Poway Road was completed in November, and another section extending this construction to north of Rancho Bernardo Road was begun in October.

The new budget will complete a six-lane freeway on Route 67 between I-8 in El Cajon and 1.7 miles northerly. It also provides funds for constructing an interchange on the Route 103 (Murphy Canyon Road) Expressway at Friars Road in San Diego.

Los Angeles Metropolitan Area

The 33 miles completed to full freeway standards in Los Angeles and Orange Counties in 1965 included the final section of the Santa Monica (Interstate 10) Freeway between the East Los Angeles Interchange and Pacific Coast Highway (Route 1) in Santa

This section of the Interstate 5 Freeway near Cardiff-by-the-Sea between Del Mar and Encinitas was completed in April. All of this important interstate route has been completed, is under construction, or has been budgeted, except for the widening and modernization of this route between south of National City and the Mexican border and through Carlsbad and Oceanside, scheduled for completion by 1972.

This seven-span bridge under construction on the Interstate 40 Freeway between California and Arizona will be completed next spring, replacing the two-lane structure at right, built for railroad use in 1890 and converted for highway traffic in 1947.

The recent opening of the Santa Monica (I-10) Freeway between Bundy Drive in West Los Angeles and the Pacific Coast Highway (Route 1) at the Santa Monica Tunnel (center) completed this freeway between the East Los Angeles Interchange and the Pacific Ocean.

Monica, and the first unit of the Pomona (Route 60) Freeway—a section between the East Los Angeles Interchange and Third Street in East Los Angeles.

Progress underway will complete the outer loop formed by the San Diego (Interstate 405) and Interstate 605 (San Gabriel River) freeways, west, south and east of the Los Angeles central district, by next summer when the I-605 Freeway will be completed southerly to I-405.

A 4.7-mile section of the I-605 Freeway was opened to traffic in September south of Whittier, completing this freeway between the San Bernardino (I-10) and Santa Ana (I-5) freeways. A connection using the Route 240 Freeway, a noninterstate facility, will complete the interchange between I-605 and the Garden Grove (Route 22) freeways by next fall.

The first completed section of the Pomona Freeway connects to four projects underway to extend it about nine miles easterly to Workman Mill Road in Industry by late 1966. This new freeway will attract much of the traffic from the older, paralleling San Bernardino Freeway in this area.

A 4.7-mile section of the Garden Grove (Route 22) Freeway was opened to traffic in late fall within Garden Grove, and another section under construction to the I-405 Freeway in Westminster will be completed by midyear, providing a continuous freeway stretch of about 10.5 miles.

Work on this route has just started from Santa Ana to the Newport (Route 55) Freeway. This latter route is under construction between Santa Ana and Costa Mesa.

The San Diego (I-405) Freeway was extended southeasterly from the Orange county line to Westminister in May and Huntington Beach in November. Another six miles will be completed next year to Costa Mesa, and funds have been budgeted to extend it another 4.5 miles southeasterly.

The Antelope Valley (Route 14) Freeway was extended eight miles easterly to the Angeles Forest Highway near Vincent in August, and is under construction northerly from this point to Palmdale.

Grading and structures for this freeway from west of Lancaster to just north of the Kern county line will start soon, and the new budget finances paving this section.

Work started in August to construct seven bridges for the future Interstate 210 (Foothill) Freeway in Monrovia and Duarte. The new budget provides funds for constructing four miles of this eight-lane freeway route between Duarte and Arcadia.

The Long Beach (Route 7) Freeway was extended northerly from the San Bernardino Freeway to Valley Boulevard west to Alhambra in February.

Construction in progress on the Route 170 (Hollywood Extension) Freeway will be completed late next year northward to Victory Boulevard in North Holywood. The new budget contains funds to extend it another 1.2 miles northerly.

Newly budgeted projects will construct five miles of the eight-lane Route 91 Freeway between just west of Bellflower and Dairy Valley; 1.5 miles of the Route 90 Freeway between Centinela Boulevard and Slauson Avenue in Los Angeles; and 0.8 mile of the first unit of the Route 57 (Orange) Freeway between the Route 91 (Riverside) Freeway east of Anaheim and Placentia.

On the Ridge Route portion of the eight-lane Interstate 5 Freeway in the mountainous terrain between the north city limit of Los Angeles and the Kern county line, 6.5 miles will be completed in mid-1967 to about a mile south of Saugus Junction, connecting to a project completed last December to south of Castaic.

The 1966–67 budget provides for funds for projects estimated to cost $17,000,000 to extend this freeway 11 miles northerly to grading construction in progress at the summit of Five Mile Grade.

Another 11.2 miles of this route is under construction from the grading project to completed Interstate 5 Freeway just north of the Kern county line.

Bids were opened in November for completing the interchange between I-5 and Route 134 freeways, and for constructing the eight-lane Route 134 Freeway from the interchange to east of San Fernando Road in Glendale. The new budget will extend this freeway another 2.9 miles to Glendale's east city limit.

Another budgeted project will widen the Santa Ana (I-5) Freeway from four to eight lanes between the Pacific Coast Highway (Route 1) south of San Juan Capistrano and the San Diego (I-405) Freeway, and to six lanes northwesterly to the Route 133 Freeway, a total distance of 16.4 miles.

San Bernardino and Riverside Counties

An 18-mile Interstate 15 Freeway project between Cronese Valley and Baker in San Bernardino County was finished in October, completing full freeway between the Nevada line and Barstow, and freeway and expressway southwesterly to San Bernardino.

Widening and conversion of about seven miles to full freeway standards in and south of Victorville is nearing completion, and work will start this winter to widen this freeway to eight lanes between the new I-5/US 395 Interchange and Cajon Summit.

The new budget allocates $20,000,000 for approximately 10.3 miles of eight-lane I-15 Freeway between Devore and Route 138 at Cajon. The project involves constructing an interchange with the future Route 31 (Devore Cutoff) Freeway, and about 1.8 miles of this future freeway route southerly from the interchange.

On the other interstate freeway route across the San Bernardino desert easterly of Barstow, Interstate 40, about nine miles were completed in the spring between Barstow and just east of Daggett, and construction of both the approaches and the four-lane I-40 freeway bridge across the Colorado River south of Needles will be completed by mid-1966.

On the remainder of I-40, three additional sections of freeway have been budgeted for construction—about 32 miles between Daggett and Ludlow; about five miles between Java and the north city limits of Needles; and eight miles extending southerly from the south city limits.

Widening of the Interstate 10 Freeway to six lanes in Ontario and to eight lanes in the Fontana area of San Bernardino County, a total distance of 14 miles, was completed in late fall.

Another 11-mile project was completed last summer to convert I-10 to a six-lane freeway between Redlands in San Bernardino County and Beaumont in Riverside County.

In the Palm Springs area, an eight-lane I-10 Freeway will be completed next summer between just east of Cabazon and Route 111, and conversion to eight-lane full freeway between Route 111 and Garnet, a distance of nine miles, has been budgeted. Included in this budgeted project are two safety roadside rests near Whitewater. Route 111 will be completed as a four-lane expressway between I-10 and Windy Point next spring.

A 10-mile stretch of four-lane I-10 Freeway to 23 miles east of Indio was completed in September; a 5.1-mile stretch east and west of Cottonwood Springs Road was completed this summer; and a 27-mile section between east of Desert Center and 18 miles west of Blythe should be completed in early 1967. The new budget provides funds to extend this freeway 20.6 miles easterly from the Cottonwood Springs Road project.

On noninterstate routes, the freeway interchange between Routes 18 and 138 near Crestline is under construction, as are two sections of the Route 18 Freeway between the interchange and San Bernardino.

The new budget will finance constructing a connecting freeway (locally known as the Crosstown Freeway) between I-15 near 16th Street in San Bernardino and Waterman Avenue (new Route 18), which will be widened and extended from 30th Street northerly to provide better interim traffic service to the mountain recreational areas.

Also newly budgeted is a 3.7-mile relocation of Route 138 as a four-lane expressway north of Crestline, because the future Cedar Springs Reservoir will inundate the existing highway. The Department of Water Resources will pay $2,200,000 of the estimated $2,700,000 cost.

The conversion of US 60-395 to six-lane freeway between east of Riverside and the University of California campus in that city will be completed this winter.

Widening of the US 395 Expressway to four lanes between south of Grand Avenue near Sun City and Route 74 south of Perris will be completed by midyear.

A four-lane, 5.5-mile Route 71 Freeway section will be completed next summer between the south city limit of Corona and the Glen Ivy Hot Springs area.

San Joaquin Valley and Central Mountain Counties

Although work continues on completing the conversion of US 99, still the major traffic arterial route through the San Joaquin Valley, to full freeway standards, construction emphasis has shifted to the Interstate 5 (Westside) Freeway, a new route along the west side of the valley that will substantially reduce travel time between the Sacramento and San Francisco Bay areas and the Los Angeles basin.

Bids were opened in September for grading about 24 miles of the future I-5 Freeway between US 99 at Wheeler Ridge in Kern County and just north of Taft Highway (Route 119), and the new budget provides funds to construct another 11.3 miles from the Lerdo Highway to Route 46 near Lost Hills.

The first unit of the Pomona (Route 60) Freeway from the East Los Angeles Interchange has been completed, connecting to construction in progress easterly to Industry. The older freeway at left is the Santa Ana (Interstate 5).

Two miles of the two-lane Route 120 (Tioga Pass Highway) Expressway in Mono County between Lee Vining and Yosemite National Park were completed this fall and another seven miles are under construction.

In Fresno County a newly budgeted 45.5-mile grading and structures project north of the Kings county line will connect to a similar 20.7-mile project northerly to the Merced county line west of Mendota, which will be completed next summer.

Construction of this new freeway between west of Los Banos and southwest of Gustine in Merced County will be completed in the spring, and work is underway to extend it northerly another 36 miles through Stanislaus County to the San Joaquin county line. A previously budgeted project will extend it to the Interstate 580 Freeway near Tracy, a spur route to the San Francisco Bay region, as well as 5.2 miles of this latter route to construction underway to 1 mile west of the Alameda-San Joaquin county line.

A newly budgeted project will construct 1.7 miles of I-5 as an eight-lane freeway north of the Stockton Channel in Stockton, and as a six-lane freeway for an additional 1.5 miles northerly.

On US 99, the new budget provides funds for expressway to freeway conway conversions in Kern County south of Bakersfield and north of Cawelo. Another is underway in Madera County, which, when completed, will provide an unbroken section of full freeway for 108 miles from McFarland in Kern County through the City of Madera.

Freeway bypasses of Ceres and Modesto in Stanislaus County were completed in the spring and summer, and work will begin soon on a freeway bypass of Ripon in southern San Joaquin County.

The new budget provides funds to extend the four-lane Antelope Valley (Route 14) Freeway 4.9 miles north of the Los Angeles-Kern county line, and to grade the first unit of the future Route 178 Expressway in the Kern River Canyon.

A 5.2-mile project on Route 178, which includes construction of a freeway section in and east of Bakersfield, will be completed next winter, and paving of 7.9 miles of the Route 58 Freeway between Keene and Tehachapi was completed by year's end.

In Kings County, a nine-mile freeway and expressway extension of Route 198 to Hanford was completed in late spring, and work began in September to continue it through and east of that city.

A freeway section on this route through Visalia in Tulare County was completed in July, and a 9.4-mile easterly extension is scheduled for completion in March.

A six-lane freeway viaduct on Route 41 to connect the US 99 Freeway with Fresno's business district began early this year.

A 12.4-mile Route 152 Expressway through Pacheco Pass around the area to be inundated by the San Luis Reservoir was opened to traffic this spring. Budgeted projects will finance extending this route as a four-lane expressway to Los Banos and adding two lanes for one mile within that city, and for converting to four-lane freeway and expressway standards between 0.8 mile west of the Merced-Madera county line and 7.3 miles easterly.

A two-lane expressway on Route 108 in Tuolumne County east and west of Long Barn will be completed by year's end and a newly budgeted project will complete a three-mile expressway bypass of Twain Harte; an 8.8-mile two-lane expressway on Route 4 from Ganns Meadow in Calaveras County to one mile east of the Alpine county line is underway.

Newly budgeted projects will finance construction of 5.2 miles of two-lane expressway on Route 49 southeast of Mariposa, and 5.4 miles of Route 132 on improved alignment between southwest of the Mariposa-Tuolumne county line and four miles west of Coulterville; and nearly four miles of two-lane expressway on Route 16 in northwestern Amador County.

East of the Sierra Nevada, two miles of two-lane expressway were completed this fall on Route 120 (Tioga Pass Highway) in Mono County west of Lee Vining; a three-mile westerly extension to the east boundary of Yosemite National Park will be completed next spring; and another 4.1 miles to three miles west of Lee Vining are scheduled for completion in late 1967.

The new budget provides funds to extend the recently completed reconstruction of Route 168 in Inyo County another 6.9 miles westerly to Camp Sabrina.

Work will start soon to construct nearly 11 miles of two-lane express-

way on US 395 between about five miles north of Independence and just north of Aberdeen.

Sacramento Valley and Northern Valley Projects

On the Interstate 5 Freeway, work has been completed, is under construction or is budgeted for 104.6 continuous miles between two miles south of Willows, Glenn County, and the Sacramento River Bridge at Antler in Shasta County.

In Sacramento County, the new budget allocates funds for about seven miles of eight- and six-lane I-5 Freeway between J Street in Sacramento and Route 99 at Bayou Way, connecting with initial two-lane expressway construction in progress on this route westerly to the Sacramento River near Elkhorn.

This budgeted project, estimated to cost $27,636,000, involves constructing paired freeway bridges across the American River upstream from the Jibboom Street Bridge.

This 1966–67 fiscal year budget also provides funds for a project costing an estimated $7,500,000, to extend a completed four-lane I-5 Freeway section in Arbuckle, Colusa County, both 5.5 miles southerly and eight miles northerly.

Work will be completed by next fall on freeway construction from two miles south of Willows to Red Bluff in Tehama County, connecting to a previously completed freeway section to south of Anderson. About 20 miles from this point to two miles north of Redding also will be completed next fall.

The new budget will finance about 16 miles of construction northerly to three miles north of O'Brien, connecting to freeway construction in progress to the Sacramento River Bridge at Antler. North of the Pit River Bridge, the work will consist of constructing two lanes for northbound traffic and reconstructing and widening the existing two-lane highway to complete conversion to four-lane freeway.

Widening the four freeway lanes and installing a median divider on the Pit River Bridge was completed in late fall.

In Siskiyou County, conversions of a short section of I-5 in and north of Dunsmuir and a 1.5-mile section south of the Oregon line to full freeway standards are nearing completion, and the budget will finance the construction of 3.3 freeway miles on this route, approximately 11 miles north of Yreka.

This newly budgeted project includes a bridge across the Klamath River to connect the existing highway north of the river with a future safety roadside rest which will be constructed on the river's south bank.

On Interstate 80, freeway progress includes conversion of 7.1 miles southwest of Vacaville in Solano County from four-lane expressway to eight-lane freeway, now nearing completion, and a 3.7-mile six-lane freeway northeast of Route 505, completed in late fall.

Construction of the superstructure of a new I-80 Freeway bridge across the Sacramento River, together with its approaches from US 40 in West Sacramento, Yolo County, to Fifth Street between W and X Streets in the City of Sacramento, will be completed by late summer.

From this point, eight-lane freeway construction is in progress for 2.3 miles easterly to Alhambra Boulevard, scheduled for completion for early 1968, joining with I-80 Freeway construction underway northerly between 29th and 30th Streets to a connection with the Elvas Freeway near A Street, to be completed by late 1966.

The Elvas Freeway and its bridge across the American River are being widened from four to six lanes to the Route 160 Freeway near the Arden Way Interchange.

The new budget will finance construction of an interchange between the I-80 and the future US 50 Freeway at the intersection of W-X and 29th-30th Streets in Sacramento. An interchange between this section of the I-80 Freeway and the Route 99 (South Sacramento) Freeway is under construction.

Work will start soon to widen 1.1 miles of the Route 160 Freeway across the American River in Sacramento from four to six and seven lanes, including construction of an additional

Shown is one of the highest highway fills in this country, required by the completion of the 12.4-mile Route 152 Expressway through Pacheco Pass around the area to be inundated by the San Luis Reservoir.

structure paralleling the 16th Street Bridge and the North Sacramento Viaduct.

On US 50, freeway construction between east of Folsom Junction, Sacramento County, and 2.2 miles east of the El Dorado county line was completed in November, connecting with a 2.2-mile easterly extension to be completed next year. A 5.5-mile section near Pollock Pines was opened to traffic last summer.

The new budget allocates funds for a 7.5-mile, US 50 Freeway section easterly from just west of Shingle Springs to the completed freeway section to Placerville.

A project to complete the Route 99 Freeway through Chico, Butte County, will be opened to traffic by midyear, and the first unit of the four-lane Grass Valley-Nevada City Freeway on Route 20, a 3.3-mile section

This section of US 50 Freeway near Pollock Pines was opened to traffic last summer.

The bridge shown at bottom under construction across the Sacramento River will carry I-80 traffic between Yolo County (left) and the W-X Street extension of this route in Sacramento, to the 29th-30th Street construction, scheduled for completion by late 1966.

in Nevada County, will be completed in 1966.

Newly budgeted are the initial two lanes of an eventual four-lane freeway on Route 70 in Yuba County between Bear River and south of Olivehurst, and a four-lane freeway from this point to Route 65 south of Marysville, including one mile of four-lane Route 65 Expressway southerly from this junction.

The new budget also provides funds to replace a bridge on Route 113 across the Sutter Bypass north of Knights Landing in Sutter County.

A 1.9-mile Route 299 Freeway section easterly from Market Street in Redding, Shasta County, was completed in August.

A two-lane expressway on Route 36 near Susanville in Lassen County will be completed next year, and the new budget provides for a 6.9-mile two-lane expressway on this route east of Chester in Plumas County.

Another Plumas County project, a 4.6-mile two-lane expressway on Route 70 near Blairsden, is nearing completion.

The 1966–67 budget will finance grading a portion of Route 139 on new alignment between Route 299 near Canby in Modoc County and 8.2 miles northerly, and for paving the northernmost 2.2 miles as the first step of two-lane expressway construction.

A 2.9-mile two-lane expressway on US 395 in Modoc County north of the Lassen county line was opened to traffic in October, completing a two-lane expressway between south of the county line and six miles south of Alturas, except for a short section in Likely.

The new budget provides for grading a portion of the Trinity County route between Weaverville and Etna via Scotts Mountain (Federal Secondary County Road 189) on new alignment between Coffee Creek and 5.8 miles northerly, and for paving the first 2.8 miles, as the first stage of two-lane expressway construction. This entire route will eventually be constructed to expressway standards as Route 3 in the state system of scenic highways.

Central Coastal Counties

Construction of interchanges on expressway sections of US 101, and replacing conventional highway sections of Route 1 with freeways and expressways, continued steadily in 1965.

Conversion of the US 101 (Ventura) Freeway near Montalvo in Ventura County to six-lane freeway is under construction, and the new budget will finance an interchange west of Thousand Oaks.

The Buellton Bypass (US 101) Freeway in Santa Barbara County was completed in June. Newly budgeted is the conversion to freeway standards of sections of this route west of Carpinteria and near Summerland.

In San Luis Obispo County, a conversion of US 101 to freeway standards north of Pismo Beach was completed in June, and work is underway to complete the conversion to such standards between Atascadero and Paso Robles.

Construction of a 4.8-mile US 101 Freeway between north of San Miguel in San Luis Obispo County and north of Camp Roberts in Monterey County was completed in August. An extension to north of Bradley will be open to traffic next summer, connecting to completed freeway northerly to San Ardo.

A US 101 Freeway bypass of King City has been financed in the new budget. Farther north, a freeway bypass of Salinas on this route was opened to traffic in early November.

On other routes in Ventura County, an 8.6-mile easterly extension of the Route 126 Freeway to Santa Paula was completed in November and construction will start early next year for 3.9 miles of the Route 118 Freeway through Santa Susana Pass. The extension of the Route 33 Freeway northerly to south of Ojai was budgeted in the 1965–66 fiscal year.

The new budget allocates $10,000,000 for a Route 23 Freeway section north of Thousand Oaks.

Work is underway to construct a two-lane expressway on Route 1 in Santa Barbara County between US 101 at Las Cruces and San Julian Ranch. About eight miles of this route will be constructed to freeway and expressway standards between Harriston and west of Orcutt next fall, as will be a two-mile, four-lane Route 135 spur between Route 1 and Orcutt. The new budget includes funds for the construction of the initial two lanes of an expressway on Route 246 west of Buellton.

Adding two lanes to the Route 1 Expressway for 4.4 miles north of the Main Gate of Camp San Luis Obispo is in progress; a 2.8-mile freeway bypass of Cayucos on this route will be completed next spring; and the new budget will finance extending the initial two lanes of the Route 1 Expressway Bypass of Cambria to north of San Simeon.

A project estimated to cost $10,000,000 has been budgeted for a 6.7-mile section of Route 1 Freeway between the south city limit of Monterey and Fort Ord, and work was started this fall on a freeway section through Castroville.

Construction of 1.9 miles of freeway is underway in Monterey County on Route 68 just west of Salinas.

Preliminary work for the Watsonville Bypass Freeway on Route 1 was completed in February, and the rest of the job will be advertised for bids in January.

In San Benito County, conversion of Route 156 to four-lane expressway between US 101 and San Juan Bautista was completed this fall, and the new budget provides funds for the initial two lanes of an ultimate four-lane expressway on this route between north of Hollister and the Santa Clara county line.

A two-lane expressway on Route 180 between south of Hollister and just north of Tres Pinos will be completed next spring.

This section of US 101 Freeway was opened to traffic in late summer, between Sylvandale and Deon Creek in Humboldt County.

San Francisco Bay Region

The Interstate 580 (MacArthur) Freeway was opened to traffic between Buell Street in Oakland and the east city limit in October, and will be completed by late spring between San Leandro and 173rd Avenue near Hayward. These two projects, costing about $17,500,000, will complete 15 miles of this eight-lane facility between the East Bay Distribution Structure and Castro Valley Junction.

The 1966–67 fiscal year budget provides for a project estimated to cost $14,500,000 for 8.5 miles of this route through Altamont Pass from just west of the San Joaquin county line to near Livermore.

Renovation of the two older two-lane bores of the Caldecott Tunnel on Route 24 through the Berkeley Hills was completed this summer, and construction of a unique system of lane control has just been completed, concurrently with 1.2 miles of eight-lane freeway from the tunnel to the future Temescal Interchange in Oakland, permitting the use of the middle bore on a reversible basis and providing four freeway lanes for the heavier direction of peak-hour traffic through the Caldecott Tunnel.

The new budget allocates funds to start the first of two projects on the Route 24 (Grove-Shafter) Freeway in Oakland which will incorporate facilities of the Bay Area Rapid Transit District in the median.

Three miles of the Interstate 680 Freeway between I-580 at Dublin and one mile north of the Alameda-Contra Costa county line were opened to traffic in December, and construction northerly to Danville will be completed by midsummer. Work started this fall on the section between I-580 and Scotts Corner, which will complete this bay area circumferential interstate freeway route from Fremont in Alameda County to Vallejo in Solano County.

About 12 miles of the four-lane Route 21 Freeway connecting I-680 at Benicia and I-80 at Cordelia will be completed in midyear. This project is financed by toll bridge revenue bonds to improve the approaches to the I-680 Bridge between Benicia, Solano County, and Martinez, Contra Costa County.

A 1.3-mile Route 13 (Warren Boulevard) Freeway section will be opened to traffic in early 1966, completing this route through Oakland.

Conversion of Route 92 to four-lane freeway between the San Mateo-Hayward Bridge and Hayward will be completed next fall.

Widening of the Nimitz Freeway (Route 17) to six lanes between Washington Street in San Leandro and Route 92 in Hayward is underway and the new budget will extend this widening another 1.7 miles southerly.

The 1966–67 budget also provides funds for an interchange on this freeway at 66th Avenue in Oakland to serve the future sports arena near this location.

In San Francisco, the Route 82 (Southern) Freeway will be extended northeasterly by next May as a six-lane facility to the site of the Islais Creek Interchange with the future freeway via Hunter's Point, and work is just starting to extend it as the eight-lane Route 87 Freeway to north of 18th Street.

The new budget provides funds to widen the James Lick Memorial (US 101) Freeway to eight lanes in the Army Streer area and to add an auxiliary lane between the Army Street on-ramp and the Route 82 Freeway.

A project now underway will connect the Route 82 Freeway at Orizaba Avenue in San Francisco with the Interstate 280 Freeway in Daly City, and this latter route to Eastmoor Avenue in Daly City by mid-1966. A southerly extension of the I-280 Freeway to west of South San Francisco has just begun, and an eight-lane freeway section from near San Bruno Avenue to Millbrae is scheduled for completion in late 1967.

The new budget allocates funds for extending this route southerly to the San Mateo Creek Bridge in and near Hillsborough, now under construction, and for an additional 2.5 miles in Woodside.

In Santa Clara County, a 4.3-mile, eight-lane I-280 Freeway section south of Page Mill Road plus a 3.9-mile, six-lane extension southerly to Cupertino are in progress. A short stretch southerly to Saratoga-Sunnyvale Road was completed in June.

A 5.5-mile section of the Route 85 Freeway between Cupertino and US 101 in Mountain View was opened to traffic at year's end.

Other San Mateo County projects completed this year include Route 1 Freeway section in Pacifica, and a Route 114 Expressway connection between El Camino Real (Route 82) and the US 101 (Bayshore) Freeway in Redwood City.

Newly budgeted is the extension of the Route 92 (19th Avenue) Freeway westerly to the site of an interchange with the future I-280 Freeway west of Belmont, and the construction of 2.1 miles on Brewer Island west of the San Mateo-Hayward Bridge.

North of the bay, a 3.1-mile US 101 Freeway section was completed in early 1965 between Novato and north of San Rafael, Marin County, and a Napa County project converted the Route 29 Expressway to four-lane freeway between Napa Creek and Napa.

A 1.1-mile section of the US 101 Freeway in and near Santa Rosa was completed in the spring, and the new budget will finance the completion of conversion of this route from expressway to full freeway standards between south of Petaluma and north of Healdsburg.

Northern Coastal Counties

A 5.5-mile US 101 Freeway bypass of Ukiah in Mendocino County was completed in November, connecting sections previously completed.

The new budget provides funds for the construction of a four-lane freeway on this route in the rugged terrain near Cummings at an estimated cost of $15,500,000. This project involves constructing the tallest highway embankment in California, and possibly the world, at Squaw Creek. It will be 372 feet high and 900 feet long.

Farther north in Humboldt County, a US 101 Freeway section between Sylvandale and Dean Creek was opened to traffic in late summer, completing 25 miles of freeway between Dean Creek and Redcrest. From this point, construction is underway to about four miles south of Scotia. The new budget will finance construction southerly from Dean Creek to Garberville.

The Fourth Street Interchange on US 101 in Arcata was completed in September as part of a continuing program of converting this route to full freeway standards.

Grading of five miles of US 101 Freeway from one mile south of the Humboldt-Del Norte county line to Klamath was completed early in 1965, and paving plus completion of the bridges across the Klamath River and its overflow channel were finished at year's end.

Another Mendocino County project, a 4.4-mile, two-lane expressway on Route 1 (Shoreline Highway) north of Russian Gulch will be completed by the middle of next year.

A much-needed, 4.5-mile, four-lane freeway on Route 299 in Humboldt County between Mad River and Blue Lake was completed in November, as was a 4.1-mile stretch of two-lane expressway on this route, including a bridge across Redwood Creek.

A 6.2-mile, two-lane expressway on Route 29 in Lake County between south of Kelseyville and Route 175 began this summer.

The budget provides funds to extend the Route 20 two-lane expressway from about six miles east of Calpella another 5.1 miles easterly.

An extension of the Route 82 (southern) Freeway in San Francisco is shown under construction toward the site of and interchange near Islais Creek with the future freeway via Hunters Point. The section shown under construction will connect with the Embarcadero Freeway at the San Francisco-Oakland Bay Bridge.

Operations

CONSTRUCTION

The current construction program includes approximately 350 active contracts amounting to nearly $600,000,000. An increase in the yearly number of contracts and total amount can be expected for the next few years, if the interstate system of highways is to be completed substantially within the allotted time and other highways are improved to meet traffic demands. This will require not only more and larger contracts, but also increased production in order to meet predetermined completion dates. Since the projects must be completed within the allotted time and funds, unless unforeseen conditions arise as the work progresses, it is necessary that experienced and well-qualified engineers be assigned to the construction work in headquarters and in the district organizations.

Construction Cost

The cost of construction has not increased as rapidly as the cost of living index, wages, or other industrial costs. This is due primarily to the introduction of new, larger and more efficient equipment which permits greater rates of production by the construction industry. During the past few years we have seen great strides in the development of equipment for all segments of heavy construction, including earthmoving equipment and machines for the construction of structures and for the placing of bases and pavements. Examples, to mention a couple, are the use of scrapers that now hold 55 cubic yards of earth each, and concrete plants capable of producing 600 cubic yards per hour. By comparison, 10 years ago scrapers may have normally hauled about 25 cubic yards and concrete production was in the neighborhood of 150 cubic yards per hour.

Along with increased production rates to meet completion dates, closer tolerances have been set up for the contractors to meet in construction of state highways. The development of the new equipment, therefore, not only must provide increased production rates but must be capable of completing the work to closer tolerances than was expected several years ago. To meet these tolerances more equipment is now appearing that is automatically controlled in both horizontal and vertical direction, such as machines for spreading and finishing bases and pavements.

The past year has seen more emphasis on the aesthetic treatment of projects in the construction phase. Thus greater attention has been given to the attempt to blend cuts and fills into the surrounding terrain, provide pleasing appearance, by texture and color, of slope paving at bridges and such features.

Advisory Capacity

The Construction Department in Headquarters acts in an advisory capacity to the various districts in construction matters. Each district provides a general program of training for its construction people, as the needs dictate. To supplement this, Headquarters Construction selects training programs in specialized complex areas such as paving and prepares the material and provides the leadership for implementing such training. These programs are directed toward practical application of construction methods and are primarily for construction personnel. However, others from Highways and from other political bodies are accommodated to the extent that space permits. Such training activities are conducted during the time of year that least interferes with the work in progress on the various construction projects.

Honor Camps

The Division of Highways and the Department of Corrections continued the joint operation of Camp 41, near Happy Camp on the Klamath River in Siskiyou County, on Route 3, and Camp 42, near Lord Ellis Summit in Humboldt County, on Route 299. Construction continued downstream on the Klamath River as far as Sandy Bar Creek, with an oiled surfacing completed between Aubry Creek and Dillon Creek. Camp 42 operations on Route 299 shifted from east of Lord

The Junipero Serra Freeway (Interstate 280) under construction between Eastman Avenue and Orizaba Avenue south of San Francisco.

Ellis Summit to the west side between Pine Creek and Preston Ranch. Paving will be completed by contract in December 1965 on a four-mile section. Construction of the new bridge at Redwood Creek is also underway with completion also scheduled in late 1965.

State route numbering has been standardized and simplified to conform with recently established national standards. Here state maintenance workers replace one old US 101 shield near Point Mugu in Ventura County with new Highway 1 sign.

Completion of the Santa Monica Freeway, shown above under construction, will provide West Los Angeles with its first east-west freeway.

MAINTENANCE

In the 1964–65 fiscal year the Division of Highways employed approximately 4,200 maintenance personnel in maintaining 14,744 miles of highways, working out of 281 maintenance stations and expending approximately $49,210,000. The above costs include maintaining state highways in 355 incorporated cities.

Roadside Rests

There are 21 roadside rests in operation throughout the state which were maintained during the past fiscal year for approximately $44,200. There are five more roadside rests under construction which will be in operation in the immediate future.

Landscaping

The Division of Highways employs approximately 770 employees in maintaining all types of landscaping on the state highway system. The cost of this work is approximately $5,250,000. At the present time there are approximately 4,300 acres classified as landscape, 2,000 acres as functional ground cover, 570 miles of screen planting for headlight glare, and 345,000 trees which are all a part of landscape maintenance. It is estimated that the cost of watering on landscape, functional planting, trees, mass ground cover and screen plantings cost approximately $870,000 for the past fiscal year.

New Routes Maintained

A total of 4.4 miles of former county roads and city streets was taken over for maintenance during the fiscal year:

Monterey County — Route 68, from Asilomar Beach State Park to the junction of Route 1—4.3 miles.

City of Oakland—Route 77, from Melrose Underpass to 14th Avenue —0.1 mile.

Pavement Repair and Bridge Maintenance

Pavement repair consists principally in applying leveling blankets, seal coat application, base restoration, surface planing, and other routine maintenance operations essential in the restoration of the surface and grade to a safe and serviceable condition. Much of this work is on heavily traveled highways and requires careful traffic control. Review by maintenance and district personnel of road surface needs justified the expenditure of $5,000,000 in the annual resurfacing and

seal coat program. This program, called the annual thin blanket program, is financed from construction funds and included 581 miles of one inch blanket of asphaltic concrete and 44 miles of deferred seal coat, at a total cost of approximately $5,000,000.

During the 1964–65 fiscal year a total of $1,900,600 in maintenance funds was expended on pavement repair. These repairs include 1,717.0 miles of traveled way and shoulder work.

Expenditure for painting and repairs to bridges as recommended by the Bridge Department amounts to $780,300.

Roadside Cleanup and Maintenance in Cities

Laws prohibiting the disposal of litter along highways and the continued distribution of litter bags by service stations have not curtailed the litter problem. In spite of the efforts of service organizations to prevent the littering of highways, roadside cleanup continues to be an expensive maintenance item. During the 1964–65 fiscal year approximately $2,600,000 was expended on roadside litter cleanup and street sweeping.

Roadside Vegetation, Tree Care and Landscaping

Roadside vegetation control has been accelerated during the past fiscal year in keeping with increasing roadside areas and development.

Roadside vegetation outside of the planted areas was controlled with chemicals where practicable and with mowers where otherwise required. The use of mowers for roadside weed control was reduced somewhat by chemical spraying. Spraying reduced the noxious weed population, thereby reducing the amounts of service contracts formerly issued to county agricultural commissioners to do the work on state roads. Spraying also eliminated several mowings normally required. Clean areas where fireguards were required were obtained by preemergence spraying, whereas grass roots were retained for erosion control where required by use of post emergent sprays while the vegetation was small and would not require subsequent mowing. Special weed spraying was required in the summer to control certain weeds which were resistant to the chemicals used in the pre and post emergent applications. Twenty-four different herbicidal materials were used for weed control on roadsides and within the landscaped plantings. It is estimated that the total quantities used covered 82,160 acres of sprayed area.

Several new chemical herbicides tested by the department during the past year showed promise of further aiding in weed control problems heretofore unsolved.

A proportioner truck was built by our Headquarters Shop for use in varied spraying with more than one material. Two 60-gallon stainless steel tanks supply concentrate of separate chemicals as required, into a proportioner pump which measures and releases the chemical into the fresh water supply coming from a 2,000-gallon stainless steel tank. The mixing of concentrate and water takes place in the main pump, where they are thoroughly mixed and sent under pressure to the discharge boom.

Experimental work was started through the year on a number of ground cover projects to determine the feasibility of spraying young tender edge growth with a contact herbicide to replace the former method of edging with a mechanical edger, a practice which was slow, expensive and hazardous in heavy traffic. It is expected that contact spraying may be done more frequently than was the mowing at a great saving of time and hazard.

Highway Signs and Pavement Markings

A trial installation of inserted epoxy markers proved successful on the mountain portion of Interstate 80 under the action of severe snowplowing and the accompanying sand, salt and ice conditions.

Thermoplastic marking material is proving economical in areas of high traffic wear at the lower elevations where no freezing is encountered.

The use of preformed marking material with a pressure sensitive adhesive base is proving very successful. This can be applied by the maintenance crew without special equipment and no waiting time for curing. The service life is comparable to that of thermoplastic material.

In the 1964–65 fiscal year $2,987,000 was expended in replacing traffic stripe, pavement markings, repairing and replacing signs.

Communications

The statewide highway radio system at the end of the 1964–65 fiscal year consisted of 1,755 mobile radio units, 241 base stations, 52 microwave stations, and 173 hand-carry units. Radio communications is currently utilized in the Maintenance, Construction, Equipment, Service and Supply, Survey, Bridge and Materials and Research Departments.

A maintenance crew does patching work on the Eastshore Freeway in Alameda County.

The division's radio system is on a scheduled replacement basis to reduce both obsolescence and high maintenance costs. At the present time approximately 60 percent of the mobile units and 10 percent of the base stations have been changed out utilizing the latest solid state technique.

During the severe storms and floods of December 1964 and January 1965, the division's communications system provided reliable communications between Sacramento and the northern districts in Eureka and Redding. In addition, communication facilities within these districts were expanded, particularly mobile radio units and hand-carry units. The reliable communications within the districts, particularly to isolated jobsites, assisted in the rapid restoration work of the state highway road system.

The division's leased private-line teletypewriter system handled approximately 2,800 messages per month. This fully automatic system, operating at 75 words per minute, interconnects all 11 highway districts and various departments at Sacramento.

The winter road information to news media, radio and television stations, newspapers, auto clubs, trucking concerns, other governmental agencies, and the traveling public was furnished by the division.

Outdoor Advertising

California's legal controls on outdoor advertising—administered by the Department of Public Works under specific mandate of the Legislature since 1933 (except within incorporated cities)—were augmented on May 15, 1965, with respect to some state highways.

On that date the Collier-Z'berg Act of 1964 became operative. It provides for more stringent regulation of certain types of outdoor advertising, limiting them as to size and frequency, on portions of the interstate highway system in California. Regulations spelling out the new restrictions were issued by the Director of Public Works, following a public hearing in Sacramento.

The number of signs and structures subject to the Outdoor Advertising Act continued the downtrend which has been evident over the past several years, as indicated by the following calendar year figures for permits issued:

	Signs	*Structures*
1962	1,826	33,258
1963	1,086	31,891
1964	1,777	30,265

The decrease in advertising structures is attributable to various factors: incorporation of new cities, annexations to existing cities, more restrictive county zoning ordinances, and additional mileage of landscaped freeways (along which billboards are prohibited). The peak year for structure permits was 1958, when 37,782 were issued. They have been going down by about 1,500 per year.

The number of advertising signs on buildings is subject to wide fluctuations—it goes up markedly in even-numbered years because of elections.

The number of advertising operators licensed for the last three fiscal years has also declined: from 884 in 1962–63 to 818 in 1963–64 and 795 in 1964–65.

The cost of administering the act has increased somewhat in recent years, largely because of the construction of many miles of access-controlled divided highways, which require additional patrolling by outdoor advertising inspectors. The Legislature increased the fee schedules for licenses and permits in 1959 and 1964 in accordance with its policy of keeping the program on a self-sustaining basis. Gross receipts from licenses, permit fees and penalties amounted to $119,473.19 for the 1964–65 fiscal year.

One of the yearly tasks of maintenance crews is snow removal from state highways. Here, a rotary snowplow removes snow from a section of Interstate 80 in the Donner Summit area.

Transportation and Encroachment Permits

Following is a comparison of the number of permits issued for both functions during the past three fiscal years:

	1962–63	*1963–64*	*1964–65*
Encroachment permits	12,453	12,507	13,508
Transportation permits	101,542	86,181	83,370
Totals	113,995	98,688	96,878

Lighting, Signals and Electrical Devices

Traffic signals, while not increasing greatly in number of intersections, are increasing very noticeably in com-

plexity. Traffic controllers and the auxiliary equipment are being transistorized, and the pressure detector is giving way to the inductive loop detector. The phasing of the intersections is becoming more complex due to traffic demand. This results in more complex equipment in the intersection. Where two or more intersections are interconnected for better flow of traffic, telemetering interconnect units are being used.

Because of the freeways with their on- and off-ramps and the large freeway interchanges, highway lighting and illuminated signs are increasing at a very high rate.

The maintenance of tunnels and tubes has increased to a point where a special crew headed by a supervising technician is being formed to handle the work. The specialized nature of this work calls for a wide knowledge of electrical and mechanical equipment.

Truck Scales

Three new truck scale installations have been completed and are located as follows:

Little River north of Arcata on US 101.

Northbound Castaic scale expanded to include brake inspection facility south of Castaic Junction.

Banning scales (replacing the existing ones at Whitewater) expanded to include a brake inspection facility for westbound movement only.

Plans are being developed for a new truck scale installation which will include a brake testing facility south of San Onofre on Interstate 5.

New loadmeter pits have been installed at several locations throughout the state where problems in connection with overloads justify their installation.

Maintenance Stations

The total cost of upkeep and repairs to the various maintenance stations throughout the state amounted to approximately $725,000.

Major new stations completed during the fiscal year include those at Elk Grove, South Sacramento, Whittier, McGee Creek, Calistoga and Redwood City, at an approximate cost of $1,021,000.

A rotary sweeper cleans gutters on the Bayshore Freeway in San Mateo County south of San Francisco.

New stations under contract and not completed are at Chula Vista, Eureka, Redding and San Diego, at an estimated cost of $922,000.

During the year, 14 major maintenance station projects were turned over to the Office of Architecture and Construction for development of plans and specifications. Most of these are new stations which are needed because of increasing work loads brought about by the constantly expanding state highway system. Every reasonable effort is being made in the design of our maintenance station facilities to insure that these stations will not only be aesthetically pleasing, but will also be compatible in construction and design to similar buildings in the surrounding area.

Road Closures

There were numerous road closures during the first part of the fiscal year of short duration, due to forest fires, minor slides at various locations throughout the state. What started out to be a normal year was brought to a sudden climax by the Christmas floods of 1964. The severity of this storm eclipsed anything that the Division of Highways had experienced since it began its operation in 1912.

There had been weeks of precipitation in the northern part of the state prior to the heavy rainfall which began on December 21 and extended through to the first part of January. The destructive storm of 1955 was almost insignificant in comparison. Rainfall at the Gasquet Ranger Station 12 miles inland along the middle fork of the Smith River for the period December 19 to 27 was 26.59 inches. At Scotia the Eel River reportedly peaked at around 750,000 cfs and 70 feet, over 200,000 cfs and 8 feet above the previous maximum in 1955. At Weitchpec the Klamath peaked 20 feet higher than in 1955. The saturated soil, due to the weeks of precipitation, had caused some local slides and road closures common in this area in any winter. State highway closures in Districts 1, 2 and 3 started on December 21 and were due in most part to flooding and debris followed by serious slides and slipouts and damaged or washed out bridges until every highway in the north coastal area was closed at one or more points with many communities including Eureka completely isolated.

To further complicate matters the weather continued bad and turned to snow in many sections so that damage assessments could only be made by foot. This resulted in the Governor's declaration of a state of disaster on December 21, 1964, resulting in emergency measures, and all available men and equipment were put to work as quickly as possible. A more detailed explanation of the Christmas flood of 1964 will be found in the January–February and March–April 1965 issues of the *California Highways and Public Works* magazine.

The magnitude of this damage can only be measured in the total cost of restoration which is approximately $36,000,000. Also $7,000,000 was re-

A maintenance crew use a giroffe and personnel hoist to make sign repairs on the San Diego Freeway in Los Angeles.

quired for emergency restoration to open the affected routes to traffic. This emergency restoration was financed with other than maintenance funds.

The unprecedented winter was not over, for the southern part of the state was enveloped in a severe storm which began the latter part of March and extended over until the middle of April. Heavy snowfall occurred in the San Bernardino Mountains and on the Angeles Crest Highway, resulting in road closures of several days' duration between Cedar Springs and Islop Saddle. Road closures of short duration occurred on several of the mountain routes in the San Bernardino Mountains.

Snow Removal

Snow removal and sanding icy pavements cost approximately $4,775,000, or 9.6 percent of the total maintenance expenditure.

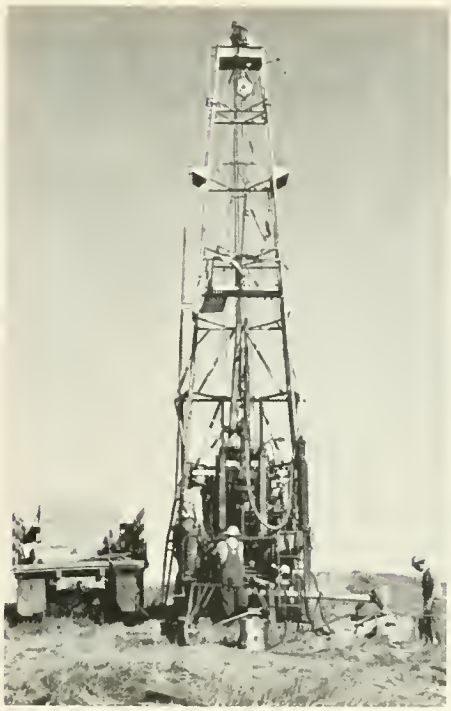
The snow pack on Donner Summit started on October 29, 1964, with a 2-inch snowfall and reached a maximum depth of 114 inches on January 9, 1965.

The last snowfall reported in the Sierra was on May 7, and there were snow flurries at higher elevarions in the late spring storms.

Maintenance crew uses personnel hoist to service highway lighting.

The Materials and Research Department serves the highway building program in several ways: It tests materials to determine their potential quality and manufactured articles to determine their compliance with specifications; provides inspection service at fabrication shops and manufacturing plants to insure the soundness of structural members and other manufactured items supplied for bridge and highway use; develops and maintains testing standards; investigates new materials, products and methods to determine their worth for highway use; initiates and performs research on testing methods and uses of materials; develops new methods of evaluating materials or quality of work; cooperates with other departments in providing technical services for research projects; supervises the record sampling and testing program; and trains certain division personnel in the use and testing of materials.

Much of the department's work is done in collaboration with other headquarters units or with the districts. The laboratories in the various districts perform some 35 different preliminary and construction control tests on soils, aggregates and paving materials, providing immediate control of materials as they enter the work and reduce time lags and costs associated with transporting test samples from remote locations, as well as insure that only quality material enters the work.



Drilling crews sample subsurface materials for foundation exploration.

Branch Offices

The Materials and Research Department operates from its central laboratories in Sacramento and its branch offices located in Berkeley, Los Angeles and Bakersfield. The Berkeley and Los Angeles offices are maintained in these two major industrial centers to accommodate the inspection work during and after fabrication on a wide variety of manufactured products used in highway construction. The Bakersfield Laboratory, on the other hand, is primarily for asphalt testing in the oil-producing areas in central California. Headquarters Laboratory performs 120 different types of tests, in addition to the 35 performed by the districts, on materials such as paint, asphalt, cement and steel that are more economically tested and controlled by a central agency.

Record sampling and testing as a backup service to the resident engineers continued to be an important function of this department. The progress record sampling portion has been delegated to the districts as well as a portion of the final record work. The results of this program continue to show that job control efforts are effective and that our specifications in general are realistic.

Major Items Are Listed

The magnitude of the direct control inspection operations of the department is illustrated by the following statistics on some of the major items released for use in highway construction during the past year.

Concrete pipe	354,000 lineal feet
Clay pipe	73,000 lineal feet
Steel pipe	1,347,000 lineal feet
Miscellaneous iron and steel	6,251,000 pounds
Guardrail	807,000 lineal feet
Treated timber	713,000 board feet
Untreated timber	48,000 board feet
Treated timber piling	362,000 lineal feet
Expansion joint	344,000 square feet
Waterstop	43,000 lineal feet
Corrugated metal pipe for culverts	716,000 lineal feet
Structural steel	40,000 tons
Reinforcing steel	218,000,000 pounds
Prestressed concrete girders, panels, deck units, etc.	1,500 each

The Field Exploration Unit drilled 4,381 lineal feet of borings for foundation investigations and slightly more than half of this work was done for the Office of Architecture and Construction in the Department of General Services. Samples were obtained

In-place densities of compacted roadway material is determined by measuring weight and volume of material removed from a carefully excavated hole.

A construction inspector teaches a trainee in the proper determination of concrete slump with the Kelly-ball device.

An engineer installs a motion picture camera into its control box for gathering data on wrong-way drivers as part of a safety study.

PHOTO ABOVE—An engineer checks data being received from a recorder inside a trailer at a jobsite. The trailer contains all the receiving and recording equipment for collecting information transmitted by strain gages used in a research study of an orthotropic bridge constructed near Dublin in Alameda County. BELOW—a chemical engineer uses a gas chromotograph to determine the constituents of paints and solvents.

from 1,517 lineal feet of borings for cut slope design.

As ground water problems are being recognized early in the investigational stages for our highways, more and more of the horizontal drains are being set up as contract items. The Field Exploration Unit was still called on to install 18,515 lineal feet of horizontal drains as corrective measures on embankment slipouts and slides of cut slopes. Maintenance of existing drainage systems called for the cleaning of 3,529 lineal feet of horizontal drains. Approximately 17 percent of this work was done at the site of the Lawrence Radiation Building for the University of California, Berkeley.

Less Inconvenience to Public

This control of ground water and quick emergency corrective measures means less inconvenience and more time for use of our highways by the traveling public.

While 75 percent of our work is associated with preliminary engineering and routine materials work, the remaining 25 percent is devoted to research. During the past year over 100 active research projects have been underway. Some of the more significant projects are included in the following outlines.

Research is being conducted on the design of embankments so that fills from 300 to 500 feet high can safely be built to permit better horizontal and vertical alignment of our modern high-speed highways.

The study of potential slipouts, including treatment with lime to increase soil strength and to reduce the tendency of soils to become unstable during wet conditions, has been underway in cooperation with personnel in District 3 in the Whitmore area on Interstate Highway 80. Data are being taken from slope indicators and inclinometers which reveal any movement of the embankment. This lime-treated embankment was placed to repair a slide which occurred during the winter of 1963–64. So far the experimental repair work is proving to be satisfactory.

The Geology Unit has completed a study on the use of color air photographs for facilitating the location of potential sources of gravel and sand suitable for highway construction materials. Preliminary studies indicate that the use of color photography may ultimately replace black and white photography in this type of work.

Evaluation of Nuclear Devices

Work is continuing in the evaluation of nuclear devices used to determine the moisture content of soils and the density of compacted earth materials. The laboratory phase of this work is now terminating and its practical field application is being evaluated. In a pilot program involving 10 construction projects these devices are being used for routine control of compaction. From this study it is expected that information will be gained on field problems concerning their use over a wide range of geographic conditions and soil types.

Among the more unusual operations of the Geology Unit has been the successful attempt to locate water well sites in desert regions for highway rest areas to be used by the motoring public and for tree planting programs.

Considerable work has been done to evaluate the skid resistance of highway surfaces. This past year over 100 road tests were performed and evaluated at different locations over the state.

Wider acceptance of the use of highway deflection measurements in selecting designs for highway reconstruction has resulted in the constant use of the traveling deflectometer. This truck and trailer instrument applies a 15,000-pound axle load and measures the resultant movement of the roadway to the nearest thousandth of an inch. Generally large movements indicate need for more extensive reconstruction than would corresponding smaller deflections. Recommendations on 50 projects were based on deflection data over the past year. A high percentage of this work was performed directly for cities and counties throughout the state.

Railing, Barriers Tested

In cooperation with the Traffic and Bridge Departments and the Bureau of Public Roads dynamic, full-scale testing has continued to improve and

perfect the design of bridge and guard rails as well as median barriers so that the traveling public can enjoy a greater degree of security on our highways.

A traffic problem which has attracted considerable attention over the past year is that of the motorist who enters freeway off-ramps from the wrong direction. The Laboratory has been assisting the Traffic Department in evaluating proposed solutions and in making photo-instrumentation studies for analysis of these wrong-way movements.

During the year the electrical laboratory instrumented a new type of steel bridge known as an orthotropic deck plate girder. This Bridge Department project involved the use of a large number of strain gages and a sophisticated complex of recording equipment housed in a field trailer. The project required over 1,200 instrumentation circuits and 30 miles of instrument cable. The Bridge Department proposes to use the stress data from this project to develop more efficient and economic bridge designs in the future.

Heavy ground water runoff through one of the horizontal drains near the Whitmore slide area in Interstate 80. The drains were successful in preventing further earth movement and damage to the roadway. Previously, slides induced by excessive trapped water had caused complete failure of the roadway.

Durability of Paint

Even the best conventional traffic paints are not durable under adverse conditions and do not provide visability at nighttime in the rain. This has encouraged continuing investigations of other materials for traffic delineation. Thermoplastic traffic marking materials now available are expected to have an increased service life, however, the wet weather visibility problem still persists with their use. To solve this problem several types of raised reflective markers have been installed at various critical areas in the state. Some have good to excellent night wet weather visibility and others which are not so effective at night have better daylight visibility. A combination of types has been recommended for adequate traffic delineation for both night and day and wet and dry conditions.

Paint research studies continue for a variety of uses. One of the more significant results of these studies comes from a 10-year study of bridge paints along coastal areas. This study has shown that an inorganic zinc-rich paint with a lithium sodium silicate binder will give up to three times the service life of the present vinyl paint system and up to six times the life of a red lead primer system.

An electrical engineer checks some of the 30 miles of cable necessary to instrument an arthotropic bridge for research purposes.

Quality Control

In a cooperative project with the Bureau of Public Roads, the Division of Highways undertook a study of construction projects to determine the potential of statistical methods for quality control. The project involves a wide variety of materials and an extremely large total number of samples and tests. Within the Division of Highways the project is a joint effort of the Construction, Bridge, Design, and Materials and Research Departments with most of the sampling and testing being performed by District and Bridge Department personnel with the Materials and Research Department performing the laboratory testing and analysis of all data.

EQUIPMENT

During the 1964–65 fiscal year, a number of changes to reduce costs were made in the Equipment Department's operation. Major changes involved rental rates, replacement of passenger vehicles, and car pool charges.

The basis for charging rental rates was changed from a monthly rent to a rate based on usage. Automotive equipment is charged now on a mileage rate. Construction type units such as rollers, motor graders, tractors, etc., are charged on the basis of hours used.

Rental rates now include the cost of fuels and lubricants. The new rates include all costs of the equipment, with the exception of the operator.

In the past, passenger vehicles were replaced at approximately the hundred-thousand-mile point. The new policy provides that these vehicles are to be replaced at any time regardless of age or mileage, when it is economical to do so. This new policy has resulted in a savings on the cost of owning and operating passenger vehicles.

The costs involved in car pool operations were transferred to the Equipment Department from the using units to give a better overall automotive cost.

Technical Training

The Technical Research and Training Section continued working on problems involving equipment research and operation. A special research project was activated to study corrective maintenance problems associated with crankcase pollution control devices. The section handled technical training activities with special emphasis on training of operators concerning the mechanical features of equipment operation. This specialized MEEEO training was given to 703 operators of the Maintenance Department for a total of 3,500 man-hours involving 42 different models of equipment.

The Design Section develops the specialized working equipment items required by the Division of Highways.

During the past year, greater emphasis has been placed on standardization. This has also resulted in substantial savings in manufacturing costs and equipment delivery. The desirability of this concept is reflected in the cost reductions experienced on numerous equipment types, although materials and labor have increased.

Equipment employees receive instruction on the operation and maintenance of the new roadside spray proportioner. This unit was developed to automatically proportion spray material while it is being sprayed and has resulted in substantial savings in material and labor.

Some Equipment Built

Whenever possible, equipment is purchased rather than built. However, in the interest of efficiency and economy, it is sometimes necessary to design and develop specialized equipment to fulfill a specific need. Typical equipment items designed and built for specialized application are listed below.

1. "Jet" Sweeper. Originally built for airfield runway cleaning, this unit was purchased for use on freeways in

EQUIPMENT DEPARTMENT SUMMARY

	June 30, 1964	*June 30, 1965*
Equipment repairs	$4,246,330.29	$4,222,519.50
Miscellaneous expense	825,887.30	1,227,844.43
Indirect and other expense	1,273,944.69	1,543,684.01
Depreciation expense	4,313,748.03	4,971,490.61
Equipment operating expense	.00	2,747,105.19
Total expense	$10,659,910.31	$14,712,643.74

EQUIPMENT INVENTORY

Trucks and passenger vehicles	*Number of units*	*Original cost*
All trucks—½ to 15 tons	4,706	$19,258,785.34
Buses, jeeps, and station wagons	195	486,087.34
Passenger cars	2,607	4,620,705.52
	7,508	$24,365,578.20
Maintenance and construction equipment		
Motor graders	275	4,800,101.48
Rotary snowplows, grader mounted	1	41,804.64
Rotary snowplows, truck mounted	57	1,982,482.98
Loaders	238	2,170,697.42
Shovels, power	11	339,961.92
Snowplows, push	558	870,997.17
Tractors	116	998,695.92
Compressors	78	334,607.24
Miscellaneous other equipment—rollers, mixers, pumps, drills, mowers, trailers, etc.	2,322	6,909,819.61
Total inventory, June 30, 1965	11,164	$42,814,746.58

southern California. Sweeping speed is approximately 25 miles per hour. Several alterations have been made to improve performance on the roadway.

2. Roadside Spray Proportioner and Water Tank. This unit was developed to automatically proportion spray material while it is being sprayed, resulting in substantial savings in material and labor.

3. Direction Chute for Rotary Snowplow. Increased roadside development has made it necessary to equip a number of these machines with operator-controlled directional chutes which are especially designed to prevent clogging with snow.

4. Fence Truck. This unit is especially designed for quick repair of center barrier freeway fence. Extra long, low-height bed and large storage boxes, hydraulic-lift tail gate and self-contained water tank contribute to the effectiveness of this unit.

5. Four-ton Maintenance Truck. This is a self-contained unit with emulsion tank and tool storage box. The emulsion tank is pressurized from the truck's airbrake compressor and has a five-gallon diesel oil storage section which is used to flush hose and gun.

6. Floating Drilling Barge. This portable platform is used by the Bridge Department geology section to make underwater drillings for bridge foundations. A standard portable drill unit is mounted on the float when in use. The unit is made up of six sections which are transported on a special trailer. Each section is filled with styrene foam to insure against leakage.

12 Shops in State

The operations of the Equipment Department are carried out in the Headquarters Shop in Sacramento and the 11 shops throughout the state. There is one of these in each of the districts of the state and, operating out of these 11 major shops, there are an additional 17 subshops as well as field mechanics. To carry out this operation requires a total staff of 704 positions.

During the past fiscal year several improvements in operations have increased shop efficiency. Among these improvements were reduced paperwork, more efficient repair policies, a department wide supervisory training course, upgrading repair equipment, and additional shop facilities.

Eliminating the use of a vehicle transfer record for local movement of units and an improved vehicle inspection process have given shop personnel more time to perform maintenance and repair jobs.

More efficient repair policies, coupled with a general upgrading of repair tools available for the mechanic's use, have reduced the time that the equipment spends undergoing repairs.

All supervisors have recently completed an extensive course in management and supervision. Improvement in their techniques has already been noted, particularly in the area of personal relations.

A new repair facility was put into operation at Shop 3, Marysville. This modern shop has greatly increased the repair and service capabilities for this district. Currently, another new shop similar in design to Shop 3, is being constructed in San Leandro to service and maintain equipment in District 4.

The general increase in efficiency and productivity at Headquarters Shop in Sacramento continued, as reflected in the decrease in cost of many of the units fabricated and assembled there.

Increase in Equipment

Overall, there has been an increase in equipment of 458 units to make a total of 11,164 units and a reduction of 14 in the number of employees required to build and repair them.

All equipment purchased by the Equipment Department is obtained by bids on specifications which are prepared to permit the maximum number of manufacturers to compete on each unit. Specifications are established to meet the needs of the operating department. During the past year, the Equipment Department has submitted specifications for 396 units of equipment. Volume purchasing of standard items has been expanded to eliminate unnecessary requisitions and purchase orders.

During the past year, $9,034,450 was expended to purchase additional and replacement equipment. 1,532 obsolete units were disposed of during the 1964–65 fiscal year. These units were sold on sealed bids for which a total of $642,763 was received. To obtain a higher recovery value on equipment, newspaper advertising has been increased with special ads and, at the present time, 1,646 names are on the prospective bidders mailing list.

The Procurement Section purchased $1,192,316 worth of spare parts for repairing items of equipment. An inventory of "hard-to-locate" items is maintained to help reduce the downtime of urgently needed equipment.

The last half of the Equipment Department *Rental Equipment Catalog* was completed and distributed. This catalog illustrates and describes the types of equipment available from the Equipment Department.

The Technical Reseorch and Training Section works on problems involving equipment improvement and operation. The session shown above concerned maintenance problems associoted with crankcase pollution control devices.

. Administration

OFFICE ENGINEER

The Office Engineer is responsible for a wide range of administrative activities, including preparation, review and processing of plans, specifications, estimates, and bid and contract documents; budget and expenditure control; administration of federal funds; industry contacts; bidder prequalification records; economic analysis; and headquarters mail and general files.

Budget and Project Control

The Budget and Project Control Section has the responsibility of insuring that the division complies with the provisions and amounts specified in the state highway budget; the processing of contract documents; preparation of financial documents submitted to the Highway Commission; preparation of reports for submission to the Highway Commission relative to projects and project financing; issuance of expenditure authorizations and maintenance of construction statistical records.

During the year, 505 financial resolutions were prepared for commission action; 602 projects having an estimated cost of $471,512,500 were advertised for bids of which 563 were determined to be satisfactory for recommending contract award.

In addition to the major contract work, the financing of 285 minor and informal contracts having an approximate value of $570,000 was cleared.

An unanticipated major work load was caused by the storms in the northern part of the state in the latter part of December 1964, the intensity of which exceeded all records and resulted in state highway damage of approximately $44,000,000. To provide for road reopening, a total of 57 emergency contracts was processed.

Plans and Estimates

Preparation of projects for advertisement requires reviewing and correlating the plans and specifications to assure that they are in agreement. Estimates of cost for all projects are reviewed prior to opening of bids so that estimates can be adjusted to conform with prevailing construction costs whenever necessary. Material information hand-outs are prepared for use by prospective bidders.

Title sheets are prepared for the larger construction projects and location maps for many of the smaller projects; last-minute changes or additions are made to the detail plans for such projects prior to advertising. Contractors' bid price extensions are checked and a complete bid summary is prepared. Contract plans are revised to show "as built" changes, right-of-way maps are recorded and filed; freeway strip maps for the interstate system are prepared. Plans showing standards of construction, four series of district and metropolitan area maps, various state maps including the highway map supplementing the annual report of the division, and the progress map, California freeway and expressway system, are prepared and maintained; and charts and maps for other units and occasionally for other state agencies are prepared.

A monthly project record-consolidated status estimate, used in conjunction with the progress and payment of all regularly advertised going contracts, is prepared. An annual tabulation entitled "Contract Item Data" is prepared as an administrative aid and management tool.

Specifications

Specifications were prepared for 602 financed projects during the year. In addition, specifications were prepared for future projects to expedite advertising for bids when funds will be available.

During the second half of the year specifications were prepared for 57 storm damage projects on state highways in the northern part of the state. The heavy rains and flooding of December 1964 necessitated the expeditious preparation of specifications, so advertising for bids and construction could be accomplished at the earliest possible date. Many of the projects were timed to permit completion of the work or opening of the road to traffic before the winter rains. These

The Division of Highways instrumented this bridge near Dublin, Alameda County, with 1,152 circuits for strain gage and deflectometer as part of a study to check design theories.

STATE HIGHWAY MILEAGE BY SURFACE TYPE

Type	*Mileage*
Concrete	1,737.884
High bituminous	8,890.799
Low bituminous	2,317.475
Oiled earth, gravel	1,025.976
Graded and drained earth	48.541
Bridges	179.716
Totals constructed roads	14,200.391
Unconstructed road	2,214.447
Total state highway system	16,414.838

STATE HIGHWAY MILEAGE BY HIGHWAY TYPE

Lanes	*Freeway*	*Expressway*	*Conventional*	*Total*
2 and 3	.428	4.035	10,784.551	10,789.014
4 and 5	1,065.348	746.580	939.163	2,751.091
6 and 7	333.949	5.170	98.351	437.470
8 and over	219.782	..	3.034	222.816
Total	1,619.507	755.785	11,825.099	14,200.391
Unconstructed roads				2,214.447
Total state highway system				16,414.838

projects were in addition to the regular planned program.

The Division of Highways *Standard Specifications* for highway projects were revised and republished, effective July 1964. These standards are used not only by the state but also by many counties, cities and other agencies as guides and references for highway work.

Economic Analysis

The Economic Analysis Unit maintains statistical records pertaining to highway construction contracts awarded, numbering 563 during this fiscal year. Records are kept for use in preparation of the quarterly California Highway Construction Cost Index, and for use in forecasting future materials requirements. Weekly and monthly reports for management purposes also are prepared showing the value of budgeted and nonbudgeted programs, and of other projects for which bids are received. The statistical supplement to this report is also compiled by this unit.

The contracts placed underway during 1964–65 covered a total of 1,363 centerline miles of state highway, including resurfacing. In addition, the Department of Public Works awarded contracts for construction on approximately 134 miles of federal-aid secondary county roads and 11 miles on state park and other miscellaneous roads, a total of 1,508 miles.

Prequalification of Contractors

Prequalification is required of all contractors who desire to bid on state highway projects estimated to cost more than $50,000. The prequalification rating, representing the maximum bidding capacity for each of the several types of work which a bidder is capable of undertaking, is established from a review of each contractor's statement of experience and financial condition. Ratings in excess of $20 million have been entered at $20 million.

The total number of contractors prequalified to bid on the various types of state highway construction increased from 774 on July 1, 1964, to 789 on July 1, 1965. The combined bidding capacity of these 789 prequalified contractors is $3,055,941,000—using the $20 million cutoff figure—which is $11,975,000 more than a year ago.

The following tabulation gives the number of contractors prequalified by the Division of Highways on July 1, 1965, arranged by the several brackets of bid ratings:

Rating	*Number of contractors*
$10,000,000 and over	88
5,000,000 to $10,000,000	168
2,500,000 to 5,000,000	248
1,500,000 to 2,500,000	327
1,000,000 to 1,500,000	395
500,000 to 1,000,000	529
250,000 to 500,000	663
100,000 to 250,000	764
50,000 to 100,000	789

Bids and Bidders

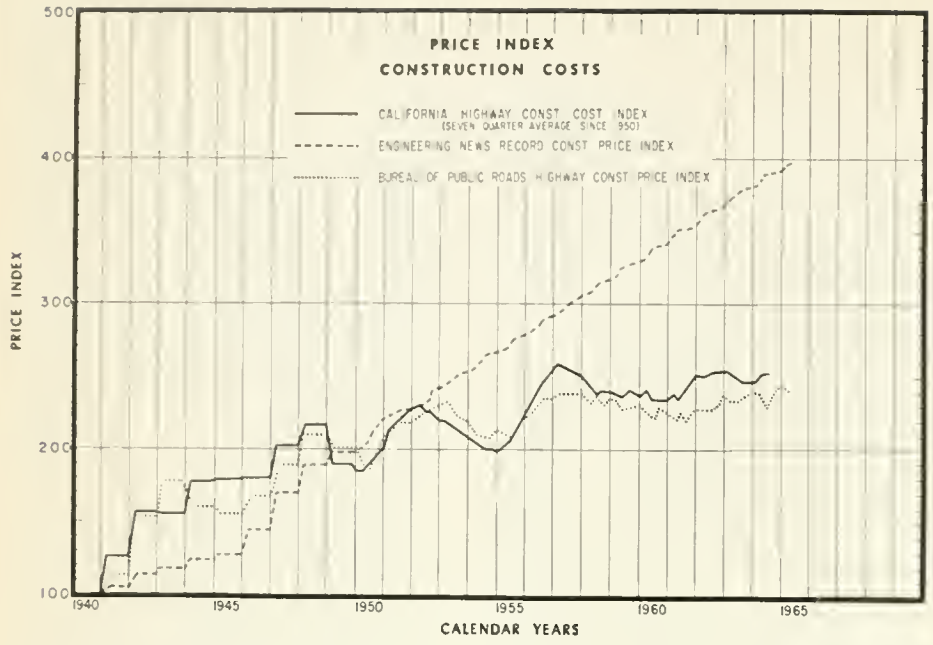
The average number of bidders per project during the year was 5.0 which was slightly lower than last year's level of 5.4. The highest monthly average of 6.1 was in January 1965. The low of 3.7 was in June 1965. The contracts awarded during the fiscal year have been arranged in eight value ranges as shown in the accompanying "Contract Value Range" table. Included in the table are the number and total value of projects making up each bracket and the percentage each bears to the total.

Street and Highway Mileages

Various highway and street mileages, with which the Division of

CONTRACT VALUE RANGE

	Number of projects	*Percent*	*Value of projects*	*Percent*
Under $50,000	229	40.7	$4,938,863	1.2
50,000 to $100,000	47	8.3	3,447,399	0.8
100,000 to 250,000	98	17.4	16,397,439	3.9
250,000 to 500,000	64	11.4	22,088,554	5.3
500,000 to 1,000,000	31	5.5	22,808,179	5.5
1,000,000 to 2,500,000	38	6.7	59,828,004	14.4
2,500,000 to 5,000,000	33	5.9	123,042,898	29.5
Over 5,000,000	23	4.1	163,920,231	39.3
Total	563	100.0	$416,471,567	100.0



Highways is directly or indirectly concerned, are shown below:

	Miles	*Miles*
Total state highway system (including portions of city streets and FAS system)		16,415
Highways proposed for construction where roads do not exist		2,215
Constructed state highways		14,200
Federal aid system		
Primary rural (12-31-64)	7,956	
Primary urban (12-31-64)	1,682	
Total		9,638
Federal aid interstate system (included in above)		2,178
Federal aid secondary system (6-30-65)		
On state highways	3,539	
On county roads	9,342	
Total		12,881
County maintained system (6-30-65)		71,013
City streets (estimated 12-31-64)		36,561
City streets on state highway system		1,993

Construction Cost Index

The California Highway Construction Cost Index reflects changes in highway construction costs. The index is founded upon weighted average contract prices for seven principal construction items in place, all referred to the base year of 1940 with a value of 100.

The fiscal year began with an index value of 249.3 in the third quarter of 1964, increased to 268.1 in the following quarter, dropped again to 249.6 in the first quarter of 1965 and rose to 269.0 in the second quarter of 1965. The average value for calendar year 1964 is 249.2.

The above graph shows a comparison between the California Index, the Bureau of Public Roads Index and the *Engineering News-Record* Construction Cost Index. The latter two indices are based on nationwide construction costs. The California Index is plotted on an average basis which describes the trend more clearly by smoothing out the fluctuations between the individual quarters.

CONTRACTS BY TYPE

This tabulation gives the number of contracts with mileage by types awarded during the 1964–65 fiscal year.

State Highway System

Number of contracts		*Centerline miles*
47	Portland cement concrete	201.6
189	Asphalt concrete	1,016.4
3	Road mix	7.6
7	Seal coat	121.5
6	Grading	16.4
76	Traffic signals and lights	
39	Bridges	
117	Miscellaneous	
484	Total	1,363.5

Not on State Highway System

	County Roads—Federal Aid Secondary	
1	Portland cement concrete	1.4
41	Asphalt concrete	104.4
3	Road mix	16.7
4	Grading	11.0
1	Traffic signals and lights	
4	Bridges	
23	Miscellaneous	
77	Total	133.5
	State Parks, Etc.	
2	Asphalt concrete	11.0
563	Totals	1,508.0

Federal Aid (1964–65)

A total of $326,043,154 in federal aid funds was apportioned to California for 1965–66 under the Federal Aid Highway Acts of 1961 and 1964. This included $21,945,130 for primary highways, $9,979,258 for secondary routes, $27,130,366 for urban routes and $266,988,400 for interstate highways. The basic federal share of primary, secondary and urban projects is 50 percent; of interstate projects, 90 percent. These percentages are increased slightly by a public land area factor.

At the start of the fiscal year, construction was in progress on 160 contracts totaling $558,551,000, of which $415,933,000 were federal aid funds.

There were 104 construction contracts involving $39,258,000 of primary funds, $34,440,000 of urban funds and $151,218,000 of interstate funds completed during 1964–65. These amounts, together with the required state matching funds, bring the combined total cost of such improvements completed during the year to approximately $301,550,000.

There were 110 contracts awarded with a total cost of $327,683,000, exclusive of preliminary engineering, involving primary, urban and interstate federal aid funds totaling approximately $264,551,000.

Eighty-five of these contracts provide for improvements on the national system of interstate highways with a total cost of $240,739,000 of which the federal share amounts to $216,295,000.

Right-of-way project agreements with the Bureau of Public Roads increased the total of interstate federal aid funds under agreement for participation in right-of-way acquisition costs by $31,728,000 to a total of $573,884,300.

In addition to the regular federal aid funds, the state receives funds for repair of highways which have suffered serious damage as the result of disaster over a wide area.

Because of the storms in northern California during December 1964, and the resultant extensive damage, estimated at $44,000,000 to state highways, the state became eligible for federal aid emergency relief funds. As of June 30, 1965, 102 projects for repair of state highways have been programmed with a total cost of $36,939,953 of which the federal share is $26,017,920, not including approximately $2,750,000 of work administered by the Bureau of Public Roads.

Industry Contact

The Industry Contact Section establishes general prevailing wage rates for heavy construction and building crafts in accordance with the applicable provisions of the statutes of the State of California. These general prevailing wage rates are published periodically and are available to other public agencies throughout the state, and many agencies make use of this material.

Establishment of equipment rental rates for use on construction force account work is accomplished in this section, and extensive files are maintained relative to heavy construction machinery and associated owning and operating costs.

Liaison is maintained with the Public Utilities Commission with respect to tariffs affecting the operation of this division, and information relating to Tariff No. 7 is distributed periodically by this office.

Regulations and procedure for the drawing up of minor contracts, right-of-way clearance contracts, informal contracts, emergency contracts, service contracts, interagency agreements and standard agreements are formulated within this section. All of these contracts and agreements are processed in varying degree within the Industry Contact Section.

Service Contracts

5,883 service contracts were processed involving a total expenditure of $11,665,000.

This type of contract is used for renting equipment and obtaining a wide variety of services. Its use is confined to work not covered by the State Contract Act and not adaptable to minor contracts, right-of-way clearance contracts and other prescribed procedures.

The principal use of service contracts, involving an expenditure of nearly $4,500,000, was for the rental of equipment for highway maintenance, for highway construction by honor camps, and for occasional day labor highway construction projects.

Minor Contracts

Small projects for which the cost will not exceed $5,000 are handled by the districts. A total of 285 minor contracts with a value of almost $570,000 were awarded during the fiscal year. The average amount per contract was approximately $2,000.

Standard Agreements

Certain types of personal services are obtained under standard agreement. During the fiscal year 133 standard agreements were processed covering such services as appraisers and expert witnesses in right-of-way matters and professional consultants in unusual design and economic investigations.

Right-of-way Clearance Contracts

As in past years, contracts were awarded to clear rights-of-way in advance of construction. 549 contracts totaling $1,786,890 were awarded for the demolition of buildings; 26 contracts totaling $225,535 were awarded for altering and moving buildings, relocating irrigation systems and fences, and drilling wells.

Emergency Contracts

Due to the floods in the northern part of the state in mid-December 1964, the Governor proclaimed a state of disaster for this area, and suspended as necessary all laws of the State of California which do or may require advertisement for bids for the purchase of supplies, employment of services, or performance of work and which prescribe procedures for the conduct of state business, including any applicable regulatory statutes, in connection with the taking of emergency and remedial measures in mitigation of the disaster. In connection with this disaster, 57 emergency contracts were processed in the total amount of $7,862,500. All of these contracts were for work to be paid for on a force account basis since there was no time to prepare plans and specifications for the necessary repair work.

CITY AND COUNTY PROJECTS

The division's City and County Projects Department continued the expansion begun in the previous fiscal year. Much of this expansion was due to the temporary increase in the gasoline tax for financing flood damage repairs (see last section of this topic titled "Flood Damage Repair"). In addition, increased staff was found necessary to administer the new 1.04-cent program described in the next section.

City and County 1.04-cent Program

The relatively new program of apportionment of the 1.04-cent gasoline tax, which funds are made available to the cities and counties under the Collier-Unruh Local Transportation Development Act, is steadily increasing in scope as the agencies avail themselves of the funds. These funds are apportioned and paid monthly to eligible cities and counties through a four-step formula using lump sums, county vehicle registrations, assessed valuation of property and city populations. A part of the program which has attained a major stature in the administration is the provision requiring that the cities and counties match a portion of the 1.04-cent funds with funds derived from other than the Highway Users Tax or State Highway Fund.

On June 29, 1965, Governor Edmund G. Brown signed Senate Bill 380, which amends portions of the existing statutes. These amendments were developed by a city-county-state committee to provide a more workable street and road improvement program under the purpose of the act. Generally, Senate Bill 380 simplifies the reporting procedures by elimination of duplication, provides more

flexibility in the select system modification process, permits review of the standards when necessary, and broadens the concept regarding matching funds. The immediate effect of this bill on the previous year will be to permit many agencies to claim matching credit for projects under construction by the beginning of the program and matching credit for projects undertaken by certain public agencies.

Though the portion of the act dealing with the new 1.04-cent program does not require formal budgeting nor prior approval of each project, as is required under the older city street program, it does provide for the review of each improvement during or following construction to the extent considered necessary by the department to verify that the act's requirements have been met. This review includes projects for which matching credit is claimed as well as projects upon which 1.04-cent funds are expended. The facets considered include verification of the project's location on the select system, its conformance to the required design standards, and the eligibility of the work for financing with the act's funds.

Approximately 2,800 project plans were reviewed by the district and headquarters engineers during the year. Many projects are also reviewed at the construction site. During the first full year that the act has been in operation, $47,299,487 was apportioned to the cities and $20,497,485 to the counties. Of this total, $2,432,800 was available for expenditure without matching. The remainder will require 50-percent matching during the year of expenditure. During the 1963–64 fiscal year, there was approximately $48,000,000 matching credit accumulated which was available to apply against 1964–65 expenditures.

Reports on actual expenditures will be made available in the agencies' annual street and road reports to the State Controller.

City 0.725-cent Program

A total of $48,051,455 was apportioned to the 395 incorporated cities during the fiscal year under Section 2107 of the Streets and Highways Code. The amount represents 0.725 cent per gallon of the gasoline tax and was apportioned on the basis of population in the incorporated cities.

The allocations of funds to cities for engineering on city streets amounted to $1,396,000 under Section 2107.5. This allocation is based on certain population brackets and ranges from an annual minimum of $1,000 to $20,000.

City budgets totaling $51,815,000 and approved by the division for delegated expenditures by the cities included $20,362,000 for construction and $6,794,000 for rights-of-way on the select system of streets and $24,659,000 for maintenance on local and select streets.

A total of 443 sets of plans, specifications, and estimates were reviewed and approved for construction during the year. These plans provided for the improvement of 182 miles of streets at an estimated cost of $31,252,000, to be financed from gas tax and other local source funds. About 65 percent of the projects were approved at the district level.

Approximately 245 cities took advantage of the increased allowance for maintenance to 60 percent. This raised the Section 2107 expenditures for maintenance some $9,000,000 and reduced the expenditures for construction and right-of-way by a like amount.

New Cities and Populations

There were seven new incorporations of cities filed with the Secretary of State during the fiscal year. There were 891 annexations to cities in the same period. There was also one merger and one official name change. The City of Dairyland became the City of La Palma on February 11, 1965. The City of North Sacramento merged with Sacramento as of January 1. The new cities and dates of incorporation were:

City	*County*	*Date*
Portola Valley	San Mateo	July 14, 1964
Morro Bay	San Luis Obispo	July 15, 1964
Thousand Oaks	Ventura	Oct. 7, 1964
Camarillo	Ventura	Oct. 22, 1964
Norco	Riverside	Dec. 23, 1964
Yountville	Napa County	Feb. 4, 1965
Rio Dell	Humboldt County	Feb. 26, 1965

This section of Putah Creek Road southwest of Winters in Yolo County was built under the federal aid secondary highway program. Lake Solano is to the left of the roadway.

The total number of incorporated cities was 395 as of June 30, 1965.

The population increase of incorporated territory is summarized as follows:

As of June 30, 1964	13,160,726
By annexation	47,255
By special federal census	34,255
By Department of Finance estimates	369,722
By new incorporations	72,378
As of June 30, 1965	13,684,336

Road and Street Systems

As specified in the Collier-Unruh Act a new "select system" of roads or streets was submitted to the department by each eligible city and county prior to October 1, 1964, and approved or modified by the Highway Commission prior to April 1, 1965. Two cities having no public streets were ineligible to submit proposals. New cities incorporated after October 1, 1964, automatically "inherited" the corresponding portion of the select system in the county area incorporated.

Initial select systems submitted and approved as above number 446 (57 counties and 389 cities). In addition 2 counties and 13 cities were granted system modifications during the fiscal year in accordance with the provisions of the act.

The total mileage in the select system at the end of the fiscal year was 37,830.64. This compares with a total mileage of public streets and roads of 105,741.20 on the same date.

During the year an additional 366.77 miles of county-maintained roads were certified to the State Controller in accordance with Section 2121 of the Streets and Highways Code. This figure is the net increase after deducting 727.57 miles lost by annexations or other causes from the 1,094.34 miles of new roads. Thirty-seven counties reported a net increase and 17 reported a decrease. Four counties reported no change. The new total of county-maintained roads was 71,013.07 on June 30, 1965.

The year's activity concerning changes in the federal-aid secondary system approved by the U.S. Bureau of Public Roads is reflected by the following mileage figures:

	6/30/64	*Change*	*6/30/65*
Local roads	9,152	+190	9,342
State highways	3,527	+12	3,539
Totals	12,679	+202	12,881

Among the new pieces of equipment purchased by the Division of Highways is this new forklift truck shown loading freeway signs on to a trailer.

Most of the changes were in the following counties:

San Luis Obispo (including Kern)	+126
Monterey	+28
San Diego	+17

FAS Program

The federal-aid secondary program in California is primarily a cooperative endeavor for the improvement of a system of principal county roads involving the use of federal, state and county funds. Projects are selected by the counties in cooperation with the Division of Highways and approved by the U.S. Bureau of Public Roads. Design standards for the improvement of these important county farm-to-market and recreational roads are similar to those used on state highways carrying comparable volumes of traffic. Projects are engineered by county forces and constructed under contracts awarded by the Department of Public Works.

During the fiscal year, 60 county FAS contracts were awarded at a total cost of $18,838,720. These funds covered construction on 120.42 miles of road and 18 bridges. In addition, two FAS contracts totaling $1,848,280 were awarded covering construction of 15.26 miles of state highway on the FAS system.

California received $10,198,300 of federal funds for secondary highways authorized for the 1964–65 fiscal year. In accordance with state statute, 87½ percent or $8,923,500 was reapportioned to the 57 counties participating in the program. The Division of Highways retained 11 percent of the total allocation or $1,121,800 for construction on state highways on the FAS system and the remaining 1½ percent for planning purposes.

A total of $4,183,300 for the 1964–65 fiscal year was allocated from the State Highway Fund in accordance with state law to supplant the counties' share of approximately 40 percent of the FAS construction costs up to a maximum of $100,000 per county. These funds were sufficient to provide the full matching requirement in 33 counties.

Urban Extension Program

The federal-aid secondary urban extension program authorized by Section 143.3 of the Streets and Highways Code in 1959 permits the Highway Commission to make allocations on an equal matching basis to cities and counties for the purpose of extending rural FAS construction into urban areas.

In the six years this program has been in operation there have been 54 projects representing allocations of state highway funds to cities in the total amount of $5,958,158 and to counties in the total amount of $6,026,203.

Allocations are limited to $500,000 to any one agency in any fiscal year and are granted on the basis that the local road or street projects were considered to be more important to the local community than improvements which would otherwise have been

made to state highways in the same area.

Flood Damage Repair

Flood damage investigating and reporting again became a primary function of the division's staff assigned to City and County Projects when during the last half of December 1964 history was not only repeated but was surpassed. As previously reported in this publication, the flood records of nine years ago (December 1955) were shattered. The crest of many of the rivers of the northwestern portion of the state exceeded the 1955 record by 20 feet and more.

In spite of the record deluge and runoff the damage to county roads and city streets was little greater than in 1955. This may be attributed in a large extent to the fact that the most vulnerable roads and bridges had been replaced with modern facilities under the Flood Relief Law of 1956. Only one such bridge was lost during the 1964 flood.

Twenty-six counties, 14 cities, and 11 special districts have applied or are planning to apply for federal or state financial assistance, or both. The costs of restoring roads and bridges on public roads not on the state highway system are estimated to be in the approximate amount of $24,500,000. After deducting the forest highway damage repaired by federal authorities there remained costs of $22,800,000 to be met by local government.

The Legislature, recognizing that the magnitude of these costs was beyond the capacities of the local agencies, enacted Chapter 27 during its 1965 Regular Session. This legislation provided for a temporary (nine months or less) increase in the gasoline tax of 1 cent per gallon beginning April 1, 1965, which was designed to provide $57,000,000, including the $22,800,000 required for the restoration of local roads, streets and bridges. After the state legislation was enacted, federal-aid under Public Law 875 was made available to local governments to provide emergency highway service. This aid was in the form of cash reimbursements totaling $3,700,000 and work by the U.S. Corps of Engineers costing $2,100,000.

The permanent restoration costs remaining estimated to approximate $17,000,000 will be met by other federal funds, since made available by Congress in the approximate amount of $5,400,000, state funds available from the temporary increase in gasoline taxes of approximately $8,700,000 and local agency matching funds of $2,900,000. The state statute provides for loans to those local agencies that are unable to immediately produce the required matching funds.

SERVICE AND SUPPLY

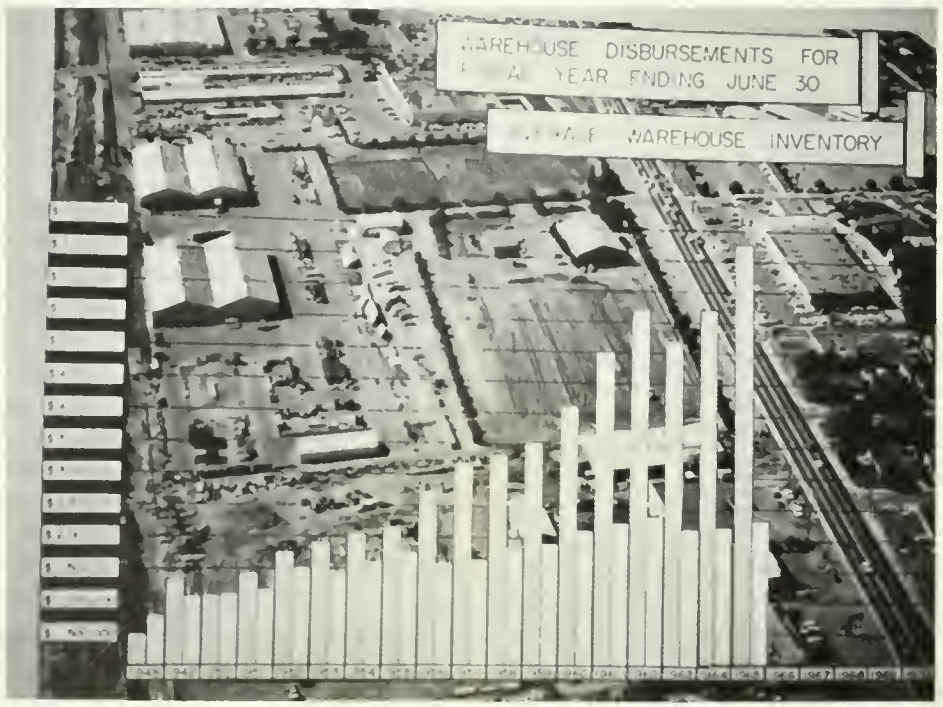
The Service and Supply Department administers the budgeting, procurement, warehousing, utilization, and disposition of property and supplies other than real estate and automotive equipment. In addition, the service section is in charge of building management, reproduction and photography in Headquarters.

The warehousing, reproduction and photography functions are self-supporting. The reimbursements from these functions account for over 85 percent of the Service and Supply budget.

Supply

Over $18,000,000 in purchases were made to keep our enormous and complex highway program in operation. Of this total, almost $7,000,000 in supplies were disbursed through the two warehouses. These warehouses, one in Sacramento and one in Los Angeles, provide rapid delivery to all points in the state. In addition to the usual warehouse items, considerable quantities of emergency materials are stocked. During the floods last winter in northern California, large quantities of these materials were airlifted to the disaster area. Many steel beams from the stockpiles have been used to restore the bridges destroyed by the flood.

A new program is being initiated to provide faster and more efficient handling of orders. The orders from the districts will be sent by teletype, checked and cleared by centralized electronic data processing inventory control in Headquarters, and then



The above chart shows the comparative increase of warehouse disbursements and average warehouse inventory over the past 18 years.

teletyped to the proper warehouse for shipment. New loading and hauling equipment at the warehouses, as well as the greater use of pallets to store and haul materials, will expedite the flow of goods to the users. The division's supply needs will be met faster and with less expense. Rapid service from the warehouses will permit smaller stocks at the user level and, consequently, savings in inventory, stockroom facilities and paperwork.

In addition, future planning includes placing all unused materials into a statewide reporting system. Using a "control by information" concept will insure maximum utilization.

To be self-supporting, the warehouses charge a markup to defray their expenses, including the freight charges to destination. This markup usually is from 10 to 15 percent; however, this year due to the streamlining of operations and the use of the 5-percent discount to reduce the previous cash surplus, the average markup was a surprisingly low 6 percent. A common measure of efficiency for warehouses is the turnover factor which is the ratio of disbursements to the inventory. This year the turnover factor was up 15 percent to a new high of 3.0.

During the past year the Supply Section experienced an increase of about 15 percent in output with no increase in personnel.

Service

The Reproduction Section provides an important service in Headquarters. The plans and specifications for highway contracts are reproduced, along with maps, manuals, forms and reports. A growing function of this section is the use of new techniques to reduce the work of draftsmen. New camera equipment being installed will facilitate the integration of many plans of different scales into one standard plan scale. "Sales" in this section total almost $600,000 during the year, which is about the same as last year.

The Photography Section continues its primary mission to provide photographic services to the districts. This includes aerial photos, ground photos, and movies. Both black and white and color pictures are taken. Other services provided by this section include pictures for the *Public Works Magazine*, services to the Public Information Section, and cooperation with the Audio-Visual Section in the production of training movies. A total of 2,167 photographic orders was processed (up 12 percent from last year).

In order to provide a more efficient relationship, 16 orientation-training meetings were held with the districts and other departments. Points of conflict were discussed and new policies and procedures were explained. Over 400 employees attended these meetings and gained a better understanding of the problems involved in the service and supply area.

The new forklift greatly speeds up the filing and removal of boxes of records in the Division of Highways records center.

SYSTEMS RESEARCH

After six months' production runs of computer-produced management reports for key personnel in all functions of the division, deficiencies were noted and, in cooperation with other headquarters units and the districts, a study was initiated to modify certain report formats to provide more meaningful information.

Utilizing EDP data, charts and graphs were developed relating actual monthly expenditures to funds budgeted by the California Highway Commission in the administration, maintenance, preliminary engineering and right-of-way functions. These charts show expenditures comparatively by districts and are used to indicate areas where the division's operations should be analyzed for reduction of costs.

In the capacity of chairman of the Budget Staff Committee, the systems research engineer assisted in analyzing the division's annual personnel and operating expense budget submittals and summarizing the data for presentation to the Budget Review Committee. Data was prepared and issued advising the districts and Headquarters units of the budget decisions made.

MANAGEMENT ANALYSIS

The Management Analysis Section, which was attached to the Systems Research Department on November 1, 1964, is a service unit established to provide assistance to districts and Headquarters departments, on request, in solving administrative and management problems through consultation and investigation. The following projects are currently under study:

Forms management program
Passenger vehicle use study
Engineering data retrieval
Staff assistance—P. & O.E. budget
Divisionwide responsibilities and authorities study
Records management study
C/L indexing system
Drafting services in Headquarters
Interdistrict mail routing
Staff assistance—project scheduling and control task force

. Planning

ADVANCE PLANNING

Freeway Routings

During the 1964–65 fiscal year the district staffs of the Division of Highways held 29 public hearings to discuss proposed freeway routings. The California Highway Commission, itself, held six public hearings during the year, four at the request of local authorities and two on its own initiative. The public hearings held by both the Highway Commission and the Division of Highways are listed in the statistical portion of the annual report.

The California Highway Commission had under consideration during the fiscal year some 45 freeway projects and adopted routings on 38 of them. These adoptions increased the freeway mileage by 212.6 miles, making a new statewide total of 7,183.6 miles of declared freeway as of June 30, 1965. This represents approximately 58 percent of the authorized freeway and expressway system as of that date.

Project Reports

The Advance Planning Section processed project reports on 240 proposed projects. Of these, 140 were major projects.

Significont Trends

There are some significant trends or developments taking place in the state highway program which are of interest.

One of these is the continual upgrading of the type of facilities provided. Just as the American consumer is buying bigger and fancier automobiles, they are demanding bigger, safer, more beautiful highways. This trend has been going on for years, but has recently accelerated. After World War II, highway construction money was very short and deficiencies were overwhelming. Of necessity, new highway construction was the minimum necessary to meet the traffic situation. In the following years, however, pavement widths have been made slightly wider; shoulders have been made wider and now are generally surfaced; median widths are greater and separated roadways are being used increasingly where terrain is appropriate; higher design speeds are being used; interchanges and separations are being placed at more frequent intervals and to higher standards; lighting and signing have been upgraded—increased use is being made of signalization, delineation, and other safety devices; a program of roadside rests is under way; and much attention is being given to landscaping, aesthetics, and beautification of highways.

All of the above incremental items in themselves have added or are adding a small degree to the cost of high-

One of the new rest areas on the state highway system is this one east of Baker on Interstate 15.

ways; however, when grouped together, the aggregate is a quite substantial increase in the cost per mile of construction. Several years ago it was estimated that the average cost per mile of the freeway and expressway system would run about $1 million. During calendar year 1964, the Highway Commission adopted about 300 miles of routes representing an average cost of about $2.6 million per mile. The most expensive single project cost was through a developed urban area, which ran somewhat over $14 million per mile. The division is now studying projects within urban areas where costs may range even higher on a mileage basis. In urban areas where costs are so high, all freeway routing studies are being coordinated in an urban transportation planning process to insure that their location and construction are integrated with other facilities to provide optimum benefits to the public and to the communities through which they pass.

Notional Forest Highways

The Division of Highways acts jointly with the U.S. Bureau of Public Roads and the U.S. Forest Service in an annual improvement program on California roads designated as forest highway routes. The forest highway network in California covers approximately 2,641 miles, about 77 percent of which is on state highway routes.

The California apportionment of forest highway funds for the 1964–65 fiscal year was $4,726,004. The amount placed under contract or otherwise obligated during the year was $4,051,480, about three-fourths of which was for projects on state highways. The unobligated balance of the apportionment is to be supplemented with 1965–66 fiscal year funds and allocated to a contract to be awarded early in the latter year.

The Bureau of Public Roads plans, designs, advertises and supervises the construction of federally financed forest highway projects. For projects on state highways, the Division of Highways works with the bureau in the planning and design phases and also obtains the required right-of-way, including clearance of utilities and options on material sites.

In addition to the above forest highway funds, about $21,000,000 has been allocated in emergency relief funds for repair of forest highways which were heavily damaged by the exceptionally high waters of flooding rivers during this past winter. The repair of this forest highway flood damage is financed 100 percent from federal funds with preparation of plans and supervision of construction by both State Highways and Bureau of Public Roads personnel. The necessary work is being accomplished under a large number of separate contracts which range in cost from about $5,000 to $1,600,000.

During the past year the portion of State Highway Route 190 between about two miles east of Springville in Tulare County and about four miles southwest of Olancha, a distance of approximately 61 miles, was added to the forest highway system. It has been designated Forest Highway 101.

Water Projects

It is a planning responsibility to determine whether the water development project proposed by various federal, state and local agencies will affect state highways. Highway planning, due to such a project, may entail provision for anything from a simple distribution system crossing to the relocation of a substantial length of highway. It may also include the negotiation of an agreement with the sponsors of the water facility to apportion the cost of the work to be done among the parties concerned.

PHOTOGRAMMETRY

The principal functions of the Photogrammetry Unit are the acquisition of aerial photography and photogrammetric mapping for various phases of the highway program.

Volume of Contracted Work

Aerial photography and most of the photogrammetric mapping has been obtained by contract, although some was done directly by Photogrammetry Unit. The volume of all contracted work for fiscal year 1964–65 is summarized as follows:

	Contracts	*Highway strip miles*	*Contract amount*
Contour mapping projects for design	16	121.9	$166,391.00
Contour mapping projects for reconnaisance	2	23.7	21,411.00
Stereoplotter rental contracts	44		179,029.78
(Compilation for design)		496.7	
(Compilation for reconnaisance)		373.8	
Aerial photography contracts	16		177,067.00
Aerial photography contracts (blanket)	16		105,161.48
Analytical Photogrammetry	2		13,190.00
Total			$662,250.26

All mapping obtained by contract procedures is checked or verified by the Photogrammetry Unit using various photogrammetric methods. This is a continuing service to district offices and provides advanced information as a guide for performing accuracy test surveys by field methods.

Photogrammetric procedures are also used for making measurements in numerical form which are not involved in the making of maps. One important application is the taking of terrain cross section data for particular design and construction projects. The cross section data are automatically recorded on punch cards by means of an electronic attachment to the photogrammetric equipment, and are used for the computation of earthwork quantities. Following is a summary of the projects completed during fiscal year 1964–65.

This point transfer device is a precision stereoscopic instrument used in the operation of photogrammetric control bridging.

Number of projects	21
Station miles	144.11
Points read and recorded	508,935
Average cost per mile	$382.68

Other applications of photogrammetric data in numerical form include photogrammetric control bridging and determination of positions of property corners and section corners.

Control Bridging

Photogrammetric control bridging is an operation aimed at the reduction of field survey effort, and provides a means of obtaining control data of sufficient accuracy for map compilation by direct-projection stereoscopic instruments. It is particularly applicable to remote, rugged, or otherwise difficult terrain which makes field surveys costly to perform. Twenty-seven such projects were completed during fiscal year 1964–65.

Position determination of property corners and section corners is a relatively new application. Research and test projects have shown that photogrammetric positioning produces results of uniformly consistent accuracy which have many applications to various design and right-of-way problems. For a corner to be definitely verified and positioned, it is necessary to find it on the ground and place a target around it to assure positive identification on the photographs.

PROGRAMS AND BUDGETS

Programs and Budgets work includes coordinating the development of statewide long-range planning programs, preparing the annual state highway budget, scheduling and controlling the advertising of construction projects, maintaining a constant check on the present and future availability of funds, and administering the division's buildings and land program.

State Highway Budget

The annual state highway budget is based on the planning program as a guide to project priorities. Many factors must be carefully analyzed to insure the most efficient use of funds. Estimates of revenue from both state and federal sources are made after consultation with other agencies involved.

After allowance for the operating needs of the division, the remaining funds estimated to be available are allocated to specific construction and right-of-way acquisition projects, in accordance with applicable legislative controls, to best serve the needs of traffic and the overall economy of the state. The responsibility and authority for final adoption of the budget rests with the California Highway Commission.

The 1964–65 fiscal year budget included approximately $807,000,000 of which approximately $315,000,000, or 39 percent, represented federal aid apportionments. The budget included nearly $500,000,000 for construction and right-of-way acquisition, providing for construction of 308 miles of multilane freeway, 25 miles of multilane expressway, 38 miles of two-lane expressway, and 118 miles of conventional highway.

Advertising Schedules

Since California's highway program is operated on a pay-as-you-go basis, careful scheduling of expenditures is necessary to insure solvency of the State Highway Fund.

Revenue comes from two sources, state highway user taxes and fees and federal aid subventions. User taxes are received monthly and motor vehicle fees annually, and can be estimated rather accurately. Federal aid revenue is received on a reimbursement basis and is therefore dependent on the rate at which those projects which are financed in part with federal funds are placed under construction. Care must be exercised to maintain a balance between federal aid and regular state highway projects to insure that expenditures do not exceed revenues.

To maintain a steady flow of construction work throughout the state and thus make the most efficient use of both state and contractors' personnel, it is necessary to maintain a close liaison with the various district offices to coordinate the many func-

tions necessary to eliminate delays in completion of plans, acquisition of right-of-way, and clearance with other agencies.

Buildings and Land

During the fiscal year construction was begun on the expansion of the District 11 office building in San Diego and the District 1 office building at Eureka. Construction began on the new Shop 3 facility at Marysville, District 4 Shop at San Leandro, and maintenance stations at Eureka, Redding, Napa, Point Reyes, San Francisco, Santa Maria, Seaside, Lompoc, Culver City, Riverside, Lodi, and Chula Vista.

Plans were being developed and/or property was being acquired for new maintenance stations or additions at 28 locations throughout the state.

Full-scale dynamic impact tests such as that shown in this photo are conducted by the Division of Highways to test design of bridge rails and median barriers.

PROJECT CONTROL

During the 1964–65 fiscal year, this new department was added within the planning function. Its purpose is to: (1) establish effective schedules for project development from first determination of need to award of contract; (2) set up necessary procedures for continuous evaluation as to the progress of each project undertaken by the Division of Highways; (3) advise division management regarding the status of projects and problem areas involved; (4) evaluate present procedures and systems in regard to the handling of projects and recommend improvements; (5) coordinate the establishment of new standardized procedures among the various districts within the Division of Highways.

In the past, the various Headquarters departments monitored their own particular phases of project development. This new department will provide an effective means of coordinating these efforts.

A special task force has been set up to accomplish the initial procedure review phase of the project control program. This task force is composed of the engineers in charge of advance planning, design, urban planning, computer systems, systems research, and office engineering. The project control engineer is the chairman of this task force.

A detailed analysis is being made of the design of off-ramps and the effectiveness of traffic control signs and devices to determine whether certain features discourage wrong-way entry more than others.

DESIGN

The Design Department and the Roadside Development Department share the responsibility for the planning and programing of the safety roadside rest system authorized by the 1963 Legislature. A tentative master plan for roadside rests has been established as a guide for financing and programing.

Geometric Design and Plan Preparation

Each interchange location or design situation presents individual circumstances, usually with some unique features. The development of an interchange plan requires considerable study and analysis of alternate plans in order that the freeway system may become an integral part of the total motor vehicle transportation system which will provide maximum traffic service, maximum safety, the least disruption of the community, and the least possible expenditure of tax funds.

During the past year, geometric designs for 192 interchanges or channelized intersections were prepared. Contract plans were completed for 464 projects, including 7,584 plan sheets.

Successful efforts to preserve the natural beauty along highways are shown in this typical scene along Interstate 80 near Cisco Grove in the Sierra Nevada. The Yuba River forms the median between the separated roadways.

Structural Design

Continuing statewide studies and field reviews are being conducted of the service performance of various structural features for the purpose of evaluating present design procedures and standards. This activity includes analysis and consideration of new pavement design methods for possible adoption.

Freeway Agreements

Agreements between the state and cities and counties establishing the treatment of local roads affected by freeway development are required for all freeway projects. In January 1965, processing of freeway agreements became a Design Department responsibility.

Through close cooperation with local agencies, 211 freeway agreements were executed during the past fiscal year.

Scenic Highways and Highway Aesthetics

The current emphasis on highway aesthetics led to the appointment this year of a Headquarters committee called the Committee on Aesthetics and Highway Beautification. The membership is composed of the engineer of design, the bridge planning engineer, and the landscape architect. The committee has general responsibility for the aesthetics of state highways. Its duties include recommending policies and procedures to effect more pleasing highways and to review and make recommendations to the State Highway Engineer on specific problems involving aesthetics. One of the first actions of this highway beautification committee was to recommend a divisionwide training course be established in the near future. This course would provide a comprehensive educational program for the design engineers throughout the Division of Highways to instruct them in design practices calculated to improve the appearance of state high-

ways as well as to display and protect the scenic wonders of the country through which the highways pass. This course is currently under consideration.

A booklet entitled *Aesthetic Considerations in Planning and Design of Scenic Highways* was issued during the past year. This booklet outlines basic principles and techniques and serves as the division's manual for scenic highway design.

Field reviews by Design Department personnel and the division's landscape architects, which were initially conducted only on scenic highways, are now being conducted on all highways. During the past year, 81 projects covering 450 miles of state highways were reviewed.

Research and Special Studies

Efforts have continued toward obtaining the optimum use of modern innovations such as the electronic computer, photogrammetry instruments, and new reproduction methods in order that engineering manpower may be conserved and more efficiently used.

Operational reports are prepared on each completed freeway project after it is opened to traffic in order that existing standards and concepts may be critically reviewed.

Tests of the standard guard rail and median barrier designs were made throughout this fiscal year. This is a joint venture involving the Design and Traffic Departments and the Materials and Research Department. The latter performed full scale collision tests of the barriers and guard rail. These have resulted in raising the guard rail from a height of 24 inches to a height of 27 inches and placing the posts at closer intervals.

Studies were made to determine a design for a glare screen to be used in the median to prevent glare from opposing headlights.

An experimental installation of a trial glare screen on Route 1 in Marin County between Waldo and Corte Madera Creek, is worthy of note. The object was to obtain relative costs of seven types of glare screen used as part of the standard cable median barrier, their durability in a coastal environment and their effectiveness as a glare screen. Future glare screen installations are under consideration.

Relaxing in comfort is easily achieved in roadside rests such as this one north of Red Bluff on Interstate 5. Beyond the comfort station on the left are additional shaded picnic tables.

The importance of project management and cost control has been emphasized in the past year. There has been increasing use of critical path methods among the designers in the Division of Highways.

The study for adopting the ring compression theory to metal culverts has been completed and the allowable height of cover has been revised. This study was made in cooperation with the Bridge Department and the Materials and Research Department.

An investigation has been made for revising the requirement of bedding and backfill for large culvert pipe and the requirements for shaped bedding under large culverts have been revised.

A model study has been sponsored at the University of California at Berkeley for the use of an aero-type culvert outlet structure in lieu of the conventional bucket dissipators used on major hydraulic structures. This work is being done in cooperation with the staff of the districts and Bridge Department. The work will be completed next fiscal year.

Drainage and Cooperative Agreements

The investigation of new techniques for improved drainage practices is continuing.

The increased use of very high embankments has necessitated special designs for drainage structures to obtain culverts of structural adequacy and economy. Increased structural problems resulting from extreme embankment heights have been handled in cooperation with the Bridge Department and Material and Research Department for obtaining designs for metal culverts and reinforced concrete arches.

The number of cooperative agreements has again increased because of the increased use of cooperative drainage projects with local agencies and also cooperative improvements of local road facilities. These have resulted in mutual benefits to the local agencies and the state.

ROADSIDE DEVELOPMENT

Previously a section of the Headquarters Design Department, Roadside Development became a separate department within the Headquarters Planning Function on July 13, 1964. In conjuction with this new organizational status, a principal landscape architect was appointed to head this department, and an increase was provided in the professional staff of landscape architects. This reorganization and expansion reflects the intention of the Division of Highways to place ever increasing emphasis upon aesthetic considerations in the design and construction of our urban and rural highways.

The responsibilities of this newly created department include the furtherance of such programs as the recently created scenic highway system, the safety roadside rest program, the screening of unsightly roadside areas, erosion control planting, and the general beautification of all of our state highways.

Scenic Highways

The principal landscape architect or his representative reviews formally and informally, with other division personnel, scenic highway projects through all phases of development from project report to actual construction. At least two formal reviews are made—one in the early planning phase, and one in the early design phase. Special considerations are given in these reviews to all scenic features to insure that the highway design will provide maximum protection and preservation of the existing scenery and will offer the most advantageous presentation of that scenery to the traveling public. The work of the Roadside Development Department in this regard is coordinated very carefully with that of the Design Department, which formulates the many aesthetic considerations into the actual roadway design plan.

Safety Roadside Rests

The Headquarters Design and Roadside Development Departments also work very closely together in regard to necessary provisions for roadside rests on our interstate and state highway routes. Planning and programing the safety roadside rest activities is the responsibility of the Design Department, and the basic design of the actual facilities is accomplished in the individual district offices. The Headquarters Roadside Development Department assists the districts by consulting with them, by reviewing site and facility plans, and by making recommendations for improvements of the designs in both functional and aesthetic aspects. This cooperative effort assures thorough consideration of the safety, comfort, and aesthetic features of each roadside rest area.

A pleasant group of native oak trees furnish a natural and comfortable roadside rest along this section of Interstate 5 in Tehama County. Facilities include a comfort station, chilled drinking water, and picnic tables and benches.

A statewide master plan of safety roadside rests has been developed to serve the traveling public. 257 roadside rest areas are included in this plan, of which approximately 26 are constructed and in use, while another 18 are under construction or budgeted. When all of the rest areas contained in the plan are in operation, motorists on major highways will be no farther than 30 minutes' driving time from some sort of rest facility (roadside rest area, local park adjacent to the highway, or commercial tourist facilities).

Roadside Planting

The Headquarters Roadside Development Department is responsible for the design and preparation of plans, specifications, and estimates for planting projects in all areas except metropolitan Districts 4 and 7. In these metropolitan districts the landscape sections do the actual plans which are then reviewed by the Headquarters Department. These projects range from small tree-planting jobs to major landscaping projects costing $500,000 or more.

During fiscal year 1964–65, approximately 36 planting project plans were completed, and 33 were processed for contracting, including both major and minor projects. The total estimated cost of these projects is $5,150,000.

Other Activities

Since many types of plants found extremely useful in highway planting are not commonly used in normal residential or commercial landscaping, a source other than commercial nurseries is necessary. The Division of Highways District 3 office administers a plant nursery at Davis which propagates and furnishes these plants for all planting projects in various areas of the state. Headquarters Roadside Development Department is responsible for seeing that appropriate varieties and quantities of plants are available, either through the nursery or by contract with commercial sources.

This department also maintains a file on city billboard ordinances and coordinates the necessary review of the legal aspects of these local ordinances. The necessity of these actions stems from the section of the law that requires an approved billboard ordinance before a planting project of "landscaping" classification can be accomplished in a given area.

TRAFFIC

Motor vehicle travel on the state highway system in 1964 was approximately 42.8 billion vehicle-miles, an increase of 9.6 percent over 1963. This was almost half of the motor vehicle travel in California. Practically all of the increase was on freeways.

Urban areas accounted for more than half (59.1 percent) of the travel although they comprise only slightly more than one-eighth (14.1 percent) of the mileage.

Freeways totaling 1,570 miles (Jan. 1965) accounted for 21.1 billion vehicle-miles, or 49.4 percent of the travel on the 14,200 mile state highway system and 24.0 percent of the total motor vehicle travel throughout the state. There were more than 2½ billion freeway trips in 1964 averaging about 9.4 miles in length.

Accidents

Average accident rates on the state highway system in 1964 were as follows:

	Total accidents per million vehicle-miles	*Fatalities per 100 million vehicle-miles*
Rural freeways	0.97	3.94
Rural expressways	2.02	8.12
Rural conventional highways	2.78	10.58
All rural highways	2.17	8.41
Urban freeways	1.61	2.21
Urban expressways	3.71	6.13
Urban conventional highways	6.09	4.51
All urban highways	3.06	3.04
All state highways	2.70	5.24

There were 115,453 accidents reported on the state highway system in 1964. This was approximately 13,600 more than 1963, an increase of 13 percent compared to an increase of 9.6 percent in the amount of vehicle-miles traveled. Increases were as follows:

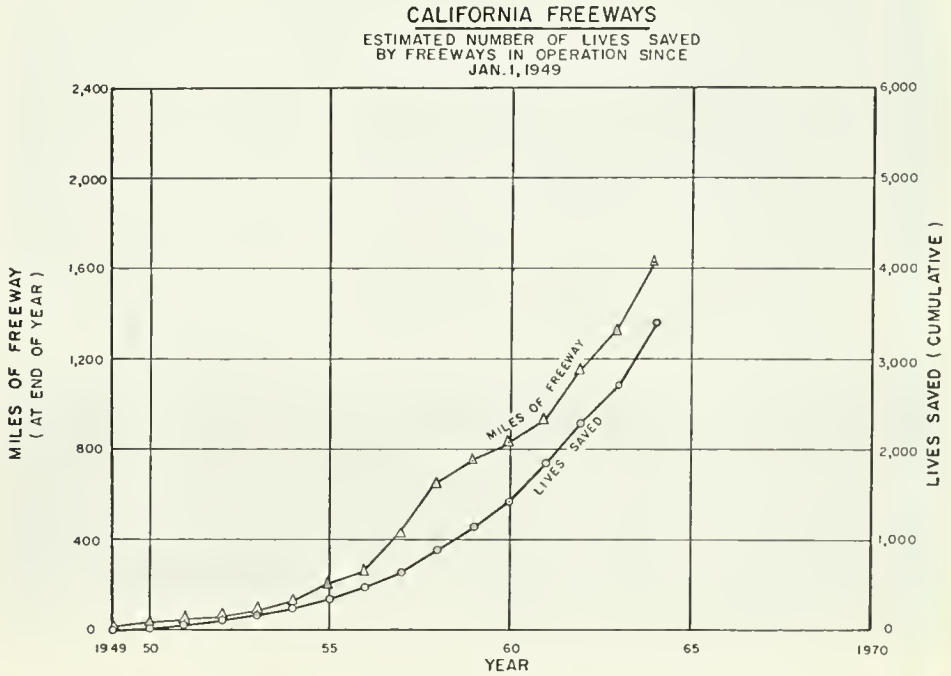
Type	*1963*	*1964*	*Increase*
Fatal	1,725	1,818	5.4%
Nonfatal injury	39,246	43,766	11.5
Property damage only	60,830	69,869	14.9

The number of accidents, amount of travel and accident rates in recent years are shown in the accompanying table.

Accident–Travel Rates

Year	*Accidents*	*Travel (billion vehicle miles)*	*Accident rates (accidents per MVM)*
1961	95,024	34.45	2.76
1962	98,292	36.36	2.70
1963	101,801	39.04	2.61
1964	115,453	42.78	2.70

If the amount of freeway travel in 1964 (4.444 billion vehicle-miles in rural areas and 16.678 billion vehicle-miles in urban areas) had been on



conventional highways and expressways, on the basis of the higher accident rates there would have been about 78,000 more accidents and more than 650 additional fatalities. On this same basis it is estimated that the freeway system completed at the end of 1964 has saved about 3,400 lives since 1949.

The installation of milepost markers on the entire state highway system was started in July 1964, following the establishment of the official post mile system on January 1, 1964. Milepost marker installations (showing reference point locations to the hundredth of a mile) will be completed by July 1966.

The milepost system of location identification is being used by the Division of Highways for all project and file reference purposes. The California Highway Patrol will also be using it to more readily pinpoint the locations where accidents occur.

Beginning in July 1965, a surveillance tabulation of accidents on the state highway system is being processed by the Traffic Department and the Computer Systems Department. Monthly tabulations show the precise milepost location of each accident and its characteristics.

The computer accident surveillance programs relieve district personnel of considerable routine work and will effect an estimated net savings of $30,000 per year in accident report studies.

The mastarm for newly designed lighting standards on freeways is a tapered curve which impraves the overall aesthetics of the freeway. The standards in the phata are being installed on Interstate 80 thraugh Sacramento.

Traffic Caunting

The automatic and mechanized annual traffic census program is now in its fifth year. It provides more useful and more accurate data, and has reduced operating costs more than $400,000 per year.

The continuing need to obtain traffic counts on all freeways (especially high-volume urban freeways), the hazards involved in placing the standard counter tubes across these facilities, and the impracticability of the tubes on multilane freeways, led the Division of Highways to adopt electric inductive loop vehicle detectors for traffic counting.

Beginning in June 1964, loop detectors have been placed in the pavement in each traffic lane between interchanges on all freeway projects except low-volume four-lane freeways. They will provide counts without hazard to departmental personnel or to the motoring public.

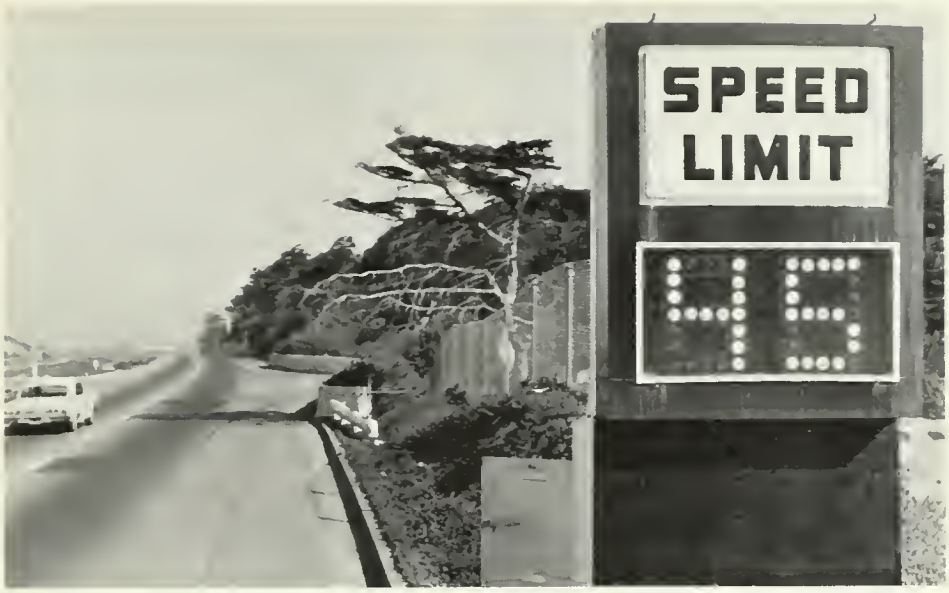
Safety Research

During the past fiscal year the Traffic Department has continued its accelerated research on highway safety. The following research projects were completed:

1. *Effect of Traffic Volumes and Number of Lanes on Freeway Accident Rates.* A study of almost 36,000 freeway accidents revealed that the accident ratio increases as the traffic volume increases. The study also found that for any given traffic volume, the accident rate is lower for six- and eight-lane freeways than it is on four-lane freeways.

2. *Effectiveness of Median Barriers.*

3. *Wrong-way Driving (Phase II).* Phase II consisted mainly of further examination of wrong-way incidents and accidents and testing on the high-



This variable message speed sign on Skyline Boulevard in San Francisco makes it possible to regulate the flow of traffic as conditions during the day vary.

way and in the U.C.L.A. driving simulation laboratory of various signs and devices to prevent wrong-way entry at off-ramps. Special warning signs have been developed and are now being installed.

4. *Continuous Freeway Illumination.* This study was an attempt to determine whether continuous freeway lighting is effective in reducing nighttime accidents.

5. *The Effect of Ramp Type and Ramp Geometry on Accidents.* Other highway safety research studies which were under way at the end of the fiscal year were:

1. *Reduced Visibility (Fog) Study.* This is a study to develop means of giving advance warning to drivers during periods of reduced visibility. A special variable speed limit sign being tested is shown in the photograph on page 47.

2. *Reporting Level of Accidents.*

3. *Machine Accident Surveillance.* Electronic data processing methods are being developed for obtaining accident information early and at frequent intervals.

4. *Evaluation of Minor Improvements.*

5. *Wrong-way Driving (Phase III).* A detailed analysis is being made of the design of off-ramps and the effectiveness of traffic control signs and devices to determine whether certain features discourage wrong-way entry to freeways more than others.

6. *Construction Zone Accidents.*

7. *Guardrail Accidents and Warrants.*

8. *Headlight Glare Study.*

Traffic Research

Research was conducted and reported to the Highway Research Board in January 1965 on a method of adapting traffic assignment data from large network traffic assignments to small area route location studies. This procedure will make it possible to use data developed in large urban transportation studies, such as the Los Angeles Regional Transportation Survey (LARTS) in route location studies.

During the year six origin and destination surveys were conducted for the purpose of gathering data on travel patterns for use in studying locations for future freeway routes. Traffic assignments were completed or underway for 25 route location studies, involving 128 alternate locations.

It is known that travel speeds and quality of service on a freeway are determined by the relationship of actual traffic demand to the capacity of the freeway or section of freeway. Research is continuing on this phase of operation and includes studies of freeway performance when this relationship is altered, in one case where channelization changes altered the capacity of various legs of an interchange and another case where a ramp closure will change the demand pattern of a section of freeway.

These studies are being conducted using aerial photography in order to test this method of evaluating freeway and street performance.

Newly designed PREPARE TO STOP signs are being placed on state highways. At the time this photo was taken on Interstate 280 near San Francisco the signs were not in operation.

The same location as in the above photo a few minutes later showing the PREPARE TO STOP signs in operation, giving motorists a warning of conditions in advance.

New in-the-railing fluorescent lighting fixtures are being installed on pedestrian overcrossing structures. The new fixture eliminates lighting poles (see next photo) and improves the appearance of the structure.

A cooperative study with the Design Department has been started to evaluate operations with various types of ramp connections and the relative merits of single ramps, multiple ramps and collector systems.

Traffic Signals and Illumination

Contract plans were completed for 175 new traffic signals and modernization of 168 existing signals. Contract plans were also completed for 4,037 lighting standards and 584 illuminated traffic guide signs. The total estimated cost of the electrical work was $9,324,680, not including the cost of the steel sign structures.

A new design for lighting standards on freeways was placed into effect.

A newly designed PREPARE TO STOP sign for use with traffic-actuated signals was placed into operation. This sign is less expensive, easier to read and more economical to operate than previous types.

Several new pedestrian overcrossing structures using the new "in-the-railing" fluorescent lighting fixture were constructed.

Traffic Regulation and Control

The program of upgrading state highway signing to comply with the *National Uniform Manual for Traffic Control Devices* was continued throughout the year. A sign contract was awarded for the new wrong-way signing package developed by the wrong-way research. The signs are being installed as rapidly as they become available.

One hundred seventy-one speed limit zones were established and 27 speed limit orders were rescinded, resulting in 273 additional miles of speed zones on state highways. One hundred thirty-eight miles of the above total were 70-mile-per-hour zones established under the provisions of Section 22356 of the Vehicle Code.

URBAN PLANNING

Legislative Reports

During the past year a number of reports were prepared for submission to the Legislature. Most noteworthy were those required by Sections 188.8, 256, and 2156 of the Streets and Highways Code.

The Section 188.8 study is made every four years to determine the state highway construction needs for a 10-year period to be used in determining percentages for computing minimum expenditures for each state highway district. A tabulation of needs for each highway district, totaling $7,368,512,000, through June 30, 1974 (10-year needs less proposed budgets through 1966–67) was submitted to the Legislature and was printed in the Senate and Assembly *Daily Journals* on January 11, 1965.

The Section 256 study is a quadrennial review of the California freeway and expressway system and the entire state highway system. The first such review and report was completed and submitted to the Legislature in December 1964 including recommended revisions and changes in these systems. During the 1965 Legislative Session, legislation was passed enacting a majority of the changes recommended by this report.

The Section 2156 report is a quadrennial report of the California city street and county road construction and improvement program, and an estimate of the local road and street needs of the next 5- and 10-year periods. All counties and cities prepared individual reports which were reviewed and consolidated by the Division of Highways. A report combining all information and estimates furnished by the cities and counties was forwarded to the California Legislature in December 1964. This report summarized the costs of the road and street needs through 1974, totaling $6,521,032,000. A 14-member advisory committee was appointed by the Legislature, which gave guidance and assistance to the department during the preparation of the report.

During the 1965 Legislative Session a report was prepared and submitted on the feasibility of including in the state highway system the county road from Truckee to Kings Beach.

Federal Studies and Projects

Two major reports were prepared and submitted to the U.S. Bureau of Public Roads during the past year. A study to determine the 1965 estimate of costs to complete the interstate highway system by 1972 was completed and the report of these costs totaling $2,416,708,000, was forwarded to the Bureau of Public Roads in July 1964.

The Recreation Advisory Council, created by the President in 1962, recommended that a national program of scenic roads and parkways be developed and asked the U.S. Department of Commerce to undertake a study of this recommendation. The U.S. Department of Commerce, through the Bureau of Public Roads, requested each state highway department to conduct this study within their respective states. With the assistance of the Advisory Committee on a Master Plan for Scenic Highways, and the participation of the cities and counties, this study was completed and the report for the State of California was submitted to the U.S. Bureau of Public Roads in January 1965.

To examine highway needs after the scheduled completion of the interstate highway system in 1972, the Bureau of Public Roads requested each state to make a study of its highway needs to 1985 less anticipated accomplishments through the end of the interstate period in 1972. At the close of this fiscal year a report for this study was being prepared summarizing statewide the mileage of roads and streets, vehicle miles traveled, and costs of improvements.

Drafting Section

Drafting for other headquarters departments amounted to one-third of the production of the section during the past year, and included preparation of maps and charts, multiple color base maps with transparent overlays, for California Highway Commission hearings and special maps of the areas damaged by the December floods. Included in the drafting services provided for the Urban Planning Department were the preparation and updating of urban area maps and maps for metropolitan studies.

Urban Transportation Planning

The documentation and description of the continuous cooperative transportation planning process required by the 1962 Federal Aid Highway Act has been accomplished for each of the state's 12 urbanized areas.

Metropolitan Transportation Studies

A formal agreement extending organizational and working arrangements for comprehensive transportation planning was accomplished in the Los Angeles Regional Transportation Study area (LARTS). The participating agencies included Los Angeles, Orange, Ventura, San Bernardino, and Riverside Counties; the Southern California Rapid Transit District; the Highway Transportation Agency; and approximately 100 cities within the region.

A technical appendix to the LARTS base year (1960) report and a brief report containing projections of 1980 population, employment, land use and vehicular traffic are under preparation. Machine techniques for traffic assignment were utilized extensively for highway system analysis and specific route location purposes within the LARTS area.

The basic report covering the origin and destination survey phase of the Eureka Area Planning and Transportation Study was published early in 1965.

The data collection phase of the South Coast Transportation Study (SCOTS) conducted in the Santa Barbara area was completed in November 1964.

Field operations for a similar study in the Bakersfield area were begun in May 1965 and are expected to be completed in November 1965.

Under agreement with the San Francisco Bay Area Transportation Study Commission, a task force of division employees was assigned to assist in the study, operating out of the Bay Area Transportation Study Commission headquarters in Berkeley.

Statistical and Nonmetropolitan Studies

The districts continued to make extensive use of the mechanical processing services provided for route location analyses. During the year processing was completed for 31 studies involving 85 freeway alternates.

Field operations for the 1964 loadometer (truck weight) survey provided axle weight, trip characteristics, and commodity data for more than 13,000 trucks at 19 locations throughout the state.

Extensive roadside interviewing and machine processing were accomplished to provide data for a feasibility study of a system of toll bridges north of the San Francisco-Oakland Bay Bridge.

As required by Senate Concurrent Resolution No. 68, 1963, the services of an independent consultant were engaged to conduct a complete investigation into the field of refunds for gasoline purchased for boats, airplanes, and agriculture. In cooperation with the consultant a representative sample of all California boat owners was selected resulting in a mailing list of some 52,000 addresses. Replies to questionnaires sent to the selected boat owners approached 40 percent of the total mailout. Analysis of the resulting data was approaching completion at the end of the fiscal year; the agricultural and aviation phases of the study were in the formative stages.

Three studies undertaken cooperatively with the Bureau of Public Roads were continued: the annual local road and street finance report covering county, city, and special district transactions for the fiscal year 1962–63 was completed; the 1964 Status of Highways on the new legislative route numbering basis was produced, and mileage tables were compiled for Bureau of Public Roads and state use; and the

This pedestrian overcrossing on the Highway 99 Freeway through Sacramento shows the old-style lighting poles on the structure which are being replaced by new in-the-railing fixtures. (See previous photo.)

Road Life and Pavement Cost Study, covering 12,200 highway miles progressed, with most mileage recorded through 1962.

Research and Special Studies

Expansion of the Division of Highways research program was continued and now includes more than 200 individual research projects, which represent an annual expenditure of almost $2 million. The Research and Special Studies Section of Urban Planning Department is charged with coordinating these projects and providing regular written status reports on each project.

This section also provides staff services for the Research and Special Studies Committee. At the direction of the committee a more detailed five-year research program was prepared which provides for a balanced research effort among the fields of: (1) reduction in accidents; (2) reduction in costs and improvement in quality of highway construction and maintenance; and (3) increase in the efficiency of highway administration and operations. An estimate was prepared, for study by the committee, of savings due to research for the fiscal years 1961–62 through 1963–64. This estimate showed that an investment of $1,938,000 in research had resulted in savings to the division of more than $18 million.

Included in the research coordinated by the Division of Highways was the Highway Safety Research Program of the Highway Transportation Agency. This program is a joint effort of the Department of Public Works, Department of Motor Vehicles, California Highway Patrol, and the Institute of Transportation and Traffic Engineering of the University of California. It is aimed at the reduction of the accident toll on California highways through a critical study of the four elements of traffic safety—the driver, the vehicle, the roadway, and law enforcement.

The Division of Highways also cooperated in national highway research activities. In May 1965 the Urban Planner was appointed to represent the State Highway Engineer in contacts with the Highway Research Board, which will include participation in an expansion and streamlining of the collection and dissemination of information relating to the nationwide highway research effort.

COMPUTER SYSTEMS

The Computer Systems Department came into existence in April 1964. The establishment of a separate department for electronic data processing functions resulted from a growing need for a general service unit which could concentrate on the provision of computer services to all parts of the division.

Advanced Planning and Research

To further the development of new computer applications, a special section called Advanced Planning and Research has been organized. Its purpose is to seek new ways of applying computer methods in such fields as highway engineering, accounting and management.

Richard A. Bjorklund, senior tabulating machine operator, runs the IBM 1460 computer system console which may be used to control the computer system and monitor its operation. Other computer system employees standing, left to right, are Theodore S. Douglas, accounting tabulating machine operator III; William J. Ellis, assistant highway engineer; and Gloria M. Anthony, highway engineering technician I.

Increasing Work Load

All computing services have increased in volume steadily over the years. For example, approximately 220,000 traverse courses are presently processed, and the earthwork program computes quantities for 25,000 cross sections per month. The vertical alignment program now computes 700,000 elevations per month, a 75 percent increase over a year ago. To meet the needs of this increasing work load the department is currently working on a three-shift basis.

New Services

Among new programs is one which allows the engineer to submit a traverse network to the computer for a network adjustment by the least squares method, a complex and time consuming calculation when attempted by manual methods. For planning and scheduling project activities such as planning, design, right-of-way, traffic, etc., a critical path program has been written to meet division needs.

A new program on accident surveillance has been developed to provide an up-to-date analysis of accident data.

A series of programs has been written to process data from the Department of Employment to code employment information for Los Angeles County into census tract. These records will eventually be processed and analyzed with other data for the Los Angeles Regional Transportation Study.

The basic accounting and reporting system underwent major revisions. These revisions decreased computer costs and increased efficiency. A system of quarterly reports was also initiated.

Pictorial communication between the computer and the engineer has been realized with the purchase of automatic plotting equipment. Of the new plotter programs now in production, two are of special interest to highway engineers. Geometrics can be plotted given a coordinated beginning point, distances and bearings. Earthwork cross sections can be plotted given cross section notes submitted for the earthwork program. For the Bridge Department, a program has been written to plot design moment envelopes.

New Equipment

During the past year, an exhaustive study of all available makes of computing equipment resulted in the decision to acquire an IBM 360 computer system. The new 360 system will be a complete departure in concept and operation from anything in the past. It offers some dramatic innovations to district users. Not only faster service and lower costs will result, but possibly direct district-to-computer input of problems and direct computer-to-district answers.

Using ultrasonic equipment, a Division of Highways crew checks the anchor bolts of the Richmond-San Rafael Bridge which were feared to have been damaged when a ship collided with the bridge pier.

Bridges

BRIDGE ADMINISTRATION

During the past fiscal year an Administration Section has been established, which includes the functions of office engineer and personnel officer, agreements, special studies and city and county projects.

Office Engineer

Management reports indicating output, output per man and operating expenses have been prepared for Planning and Operations. To create more efficient and usable management reports the Bridge Department is moving towards greater use of electronic data processing equipment.

Railroad Grade Crossing Agreements

Construction was started, underway, or completed on 45 highway projects requiring negotiations with railroads which involved right-of-way encroachments, installation of additional crossing protection, construction, alteration or abandonment of grade crossings. Negotiations with the railroads were in progress for 31 additional highway projects. In addition, 25 projects involving negotiations and construction for improvement of existing crossing protection were completed or underway.

On federal aid secondary routes, negotiations were underway or completed on 15 projects with railroad involvement.

Railroad Grade Separation Structures

At the beginning of the year, 60 railroad-highway grade separation structures were under construction. A total of 36 separation structures were placed under contract during the year. During the year 35 separation structures were completed.

$5 Million Grade-crossing Fund

The Public Utilities Commission issued the 1964 priority list containing 34 proposed separation projects to eliminate railroad grade crossings and reconstruct existing separation structures on county roads and city streets. In accordance with state law, $5,000,000 in state funds is set aside by the Highway Commission each year to pay half the cost of each separation project after deducting the railroad contribution.

As of June 30, 1965, allocations totaling $5,000,000 had been made by the Highway Commission from the 1964–65 fiscal year funds for eight of the top priority projects on the PUC list.

A view of the graceful ramp system on the Santa Monica-San Diego Freeway interchange in Los Angeles. Ground level street in foreground is National Boulevard.

Corps of Engineers and State Reclamation Board Permits

During the past year, permits have been received from the Corps of Engineers to construct three bridges across the Sacramento River, and one bridge each across San Rafael Harbor and Anaheim Bay. Permits were received to construct a ferry slip at Franks Tract Recreation Area, replace pier and boating facilities at Angel Island State Park, rehabilitate an existing bridge across Anaheim Bay and redesignate the American River Bridge at Jibboom Street as a fixed-span bridge.

The State Reclamation Board approved plans to construct 17 new bridges across tributaries of the Sacramento and San Joaquin Rivers.

City and County Projects

The city and county bridge projects office reviews the plans and specifications for structures built by local governments and financed from gas tax funds. Structures for which the local governments request credit as matching fund projects receive a similar review. During the year plans and specifications were reviewed for 95 such structures.

Plans were checked and specifications were written for 19 federal aid secondary structures valued at $4,700,000. Contracts were awarded for construction of 18 federal aid secondary structures at a cost of $5,900,000. Design work for 18 of the planned structures was performed by county engineering staffs or consultants retained by the counties. One structure was designed by the state as a part of a state freeway contract.

The floods of October 1963, February 1964, and December 1964 were particularly injurious to city and county bridges. During the December 1964 floods, 109 city and county bridges were destroyed and 88 were damaged. Loss to city and county bridges is estimated at $8,000,000. The city and county bridge projects engi-

Bridges on the State Highway System Segregated as to Number, Length and Area by Structure Type as of June 30, 1965

Structure type	Number 1965	Number 1964	Length[a] (feet) 1965	Area[b] (square feet) 1965
Concrete arch	216	229	35,603	814,089
Concrete girder	2,657	2,361	621,125	39,412,429
Concrete slab	2,581	2,483	154,886	6,807,236
Masonry arch	31	32	933	21,133
Subtotal, concrete and masonry	5,485	5,105	812,547	47,054,887
Steel arch	6	6	2,618	42,655
Steel plate girder	369	374	182,227	8,393,814
Steel stringer	261	274	57,376	3,582,280
Steel deck truss	27	30	31,684	1,528,060
Steel pony truss	28	29	10,374	169,631
Steel through truss	62	62	114,264	1,468,629
Suspension	2	3	20,494	1,007,621
CMP multiplate and arch	79	76	1,514	51,512
Subtotal, steel	834	854	420,551	16,244,202
Timber arch	1	1	59	780
Timber stringer	525	538	40,592	1,395,039
Timber deck truss	4	5	809	17,734
Timber pony truss	0	0	0	0
Timber through truss	0	0	0	0
Subtotal, timber	530	544	41,460	1,413,553
TOTAL BRIDGES	6,849	6,503	1,274,558 (241 miles)	64,712,642 (1,486 acres)
Underpasses	185	183		
Overheads *	324	292		
Combined bridge and overheads *	63	56		
State highway separations *	367	323		
Road undercrossings *	1,483	1,292		
Road overcrossings	1,067	934		
Pedestrian undercrossings *	195	182		
Pedestrian overcrossings	112	99		
Cattlepasses *	91	90		
Tunnels	22	22	22,242	
Special retaining walls	6	6	4,707	
Miscellaneous	20	20	400	10,325
TOTAL STRUCTURES	8,261	7,767	1,301,907	64,722,967
Drainage pumping plants	213	206		
Railroad grade crossings	618	629		

* Separations so noted are listed under structure type above.

NOTE: Twenty-five overheads, one tunnel, and four bridge and overheads also serve as state highway separations.

[a] Structures of assorted types and lengths of spans are by number and length under main span types.

[b] Areas are based upon clear widths of roadways between curbs and clear sidewalk widths.

neer provided estimates, catalogued damage, offered advice to local government engineers as to repairs or replacement, and reviewed plans for projects using state or federal flood relief funds.

Special Studies

The past year's efforts in the field of bridge research were highlighted by the instrumentation and testing of an experimental orthotropic plate bridge at Dublin and the initiation of major research on flexible culverts under high fills. Other research included investigations of the problems encountered in widening bridges, a study of magnitudes of our bridge movements produced by variation in temperature and climate, a study of factors influencing slab deflections, and continuing efforts in the search for a satisfactory joint sealer.

Research projects completed at the University of California and administered by the Special Studies Section included a bridge barrier rail literature search, analysis of seismic effects on piles in deep clay deposits and a study of a skewed anisotropic plate. Current investigation being performed by the university for the division include the influence of load and environment history on the cracking of concrete and a computerized theoretical analysis of box girders.

A research agreement with Sacramento State College was initiated for studies concerning soil pressures surrounding buried conduits.

During the year, results of the Harrison Street box girder studies, performed as a joint effort of the Bridge Department, Materials and Research Department and the University of California at Berkeley, were published by the Highway Research Board.

The well-publicized floods of December 1964 instigated many special hydraulic and bank protection studies in the northern part of the state. Hydraulic studies were confined to investigation and analysis at specific sites by the section's hydrologist, while work in the bank protection field comprised representation on the division's bank protection committee, members of which toured the flood devastated area to provide consultation and make recommendations.

The year's accomplishments in electronic data processing included the production of several management reports to assist in the department's administrative tasks and the introduction of several new programs, including composite steel girder analysis, substructure analysis, prestressed girder analysis, prestressing cable friction analysis, geometric layout plotting and equipment inventory.

One of the 1965 awards of merit by the Prestressed Concrete Institute was to Mackinnon Avenue Overcrossing on Interstate 5 in San Diego County.

BRIDGE PLANNING

Advance Planning

During the past fiscal year 567 preliminary bridge reports representing about $146,000,000 of contract work were prepared and forwarded to Design. There was increasing emphasis on structure appearance and the relationship of structures to overall highway aesthetics. Twenty-four architectural models were constructed by the Bridge Architecture Section for legal use and public display, and as an aid in design.

Extensive studies were made for the "Panhandle" and "Golden Gate" Freeways in San Francisco. In an effort to make the proposed construction compatible with local problems, these studies included cut-and-cover tunnels, bored tunnels, subaqueous tunnels and cantilever viaducts as well as the more usual type structures.

The December 1964 flood in northern California resulted in heavy bridge loss and damage. This imposed an unexpected burden to an already crowded schedule of advance planning activities. Notwithstanding this, all storm damage planning work was completed by the end of the fiscal year without impairment of the normal work load.

Foundation Section

The Engineering Geology Section conducted over 500 foundation investigations including 130,700 lineal feet of exploratory borings for bridges and retaining walls during the past year. Major projects included the Stockton Channel Viaduct, the American River Bridge on Route 5, Route 80 Freeway structures in Sacramento, the San Diego River Interchange, and Crestline Viaducts. A considerable amount of work was done on studies for flood damaged bridges in Districts 1 and 2.

The successful installation of bell-type caissons for the Fort Sutter Viaduct (I-80 in Sacramento) was accomplished during the year. This is the first major job in California using this type of foundation.

Design

One of the largest and most interesting bridges for which plans were completed was the San Mateo Creek Bridge (I-280) in San Mateo County. The bridge is presently under construction as a separate contract at a cost of $5,795,000.

The bridge carries eight lanes of traffic and a 22-foot divider and is 1,695 feet long.

The feature of the San Mateo Creek Bridge is the unusual piers which have a maximum height of 250 feet above the creekbed. The entire superstructure is supported on the two-legged piers.

In the bay area the plans for the third and final unit of the Southern Freeway were completed. The cost of the structures in this unit was $6,000,000.

Included in the project was an unusual retaining wall at Potrero Hill. This wall is 880 feet long and has a maximum height of 60 feet. The wall consists of a series of thin arches which are anchored with prestressed rods into the rock behind the wall.

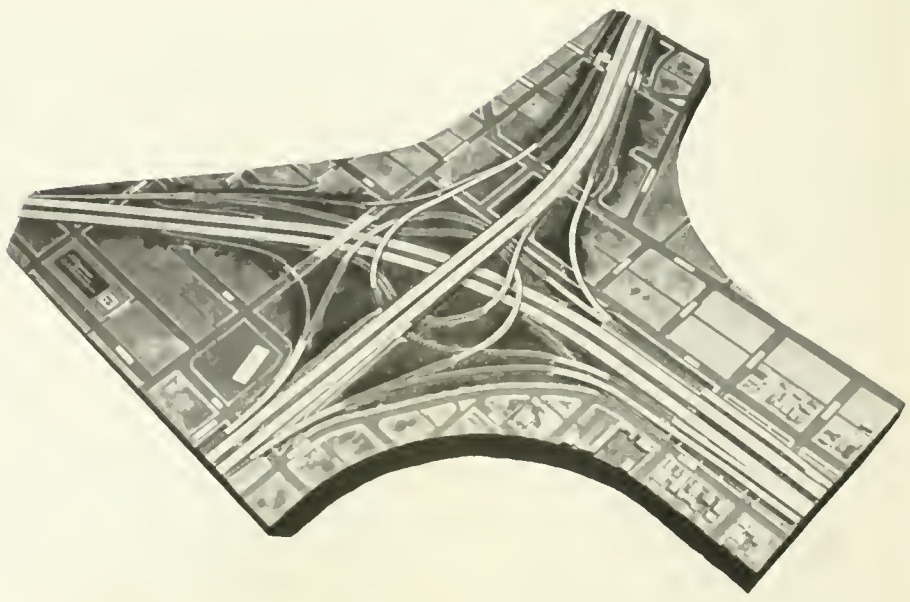
In the Los Angeles area plans were completed for the first unit of the interchange between Routes 90 and 405. The ultimate cost of the structures in the complete interchange will be $7,705,000.

An important first for the Los Angeles area was the completion of the first unit (near Covina) of Interstate 210 which will eventually extend from Interstate 5 near the foot of the Ridge Route through the foothill country and connecting with the San Bernardino Freeway near Pomona.

A new four-lane bridge was designed to replace the existing narrow Anaheim Bay Bridge on Pacific Coast Highway (Route 1). The adjacent county bridge will be used as a detour during construction.

In the San Diego area, plans were completed for the Old Town Interchange located on Interstate 5 near the San Diego River in San Diego. The interchange will cost about $7,500,000.

An unusual project completed during the year was the lane control system at the Caldecott Tunnels between Alameda and Contra Costa Counties. Upon completion of the third tunnel and until the future fourth tunnel is built, the center tunnel is operated to carry peak traffic. There are eight traffic lanes approaching the tunnels and only six lanes available through the three tunnels. The traffic control system permits the direction of traffic through the center tunnel to be oriented to coincide with the predominant flow. This will provide four lanes in the direction of the heavier flow and two lanes in the direction of the lighter flow. This Division of Highways designed equipment consists of electric



This model of the Oak Park interchange in Sacramento shows the ramp system connecting Interstate 80 and Highways 50 and 99.

changeable message signs to direct traffic into proper lanes, plastic cones which pop up under pneumatic pressure to delineate the lanes in service, and finally, positive cable barriers to insure against wrong-way mistakes. These barriers retract into underground galleries alternately depending on direction of traffic flow.

Plans were completed for all structures on the Interstate 80 Freeway between the Sacramento River and the connection with the construction underway on 29-30th Streets. The most notable structure in this group is the Camellia City Viaduct running from 18th to 24th Streets.

The plans for widening of the American River Bridge at Elvas on Interstate 80 were completed. Design for the structures on Interstate 5 north of J Street in Sacramento to the Sacramento River at Elkhorn are well underway.

The December 1964 flood damage to the bridges increased the workload in Design. In addition plans were prepared for 23 new bridges to replace ones that were washed out or severely damaged. Plans for another 14 structures requiring major repairs were also turned out.

Vincente Creek bridge on Highway 1 also received an award of merit from the Prestressed Concrete Institute for 1965.

Bridge Construction Costs

Bridge construction costs, as measured by the Bridge Department Construction Index (1939–40 = 100), showed readings of 267, 296, 302 and 318 for the four successive quarters of the 1964–65 fiscal year. The rising costs were due to the generally increased demand for construction services. An especially heavy demand was generated by the reconstruction of bridges in the northern area due to the December 1964 floods.

BRIDGE OPERATIONS

Bridge Construction

Eighty-two structures in 70 Bridge Department-administered contracts totaling $30,000,000 were completed during the year. This included the Caldecott Tunnel (9.8 million) and the substructure of the Interstate 80 Freeway Bridge over the Sacramento River (1.2 million).

There were also 469 structures totaling $70,000,000 in 103 district-administered contracts.

There were 186 structure projects with an approximate cost of $184,264,000 underway at the end of the fiscal year.

The 1964–65 state highway budget had $143,192,000 in structure work in 159 projects. Emergency contracts for flood work in the northwestern part of the state amounted to $3,383,000 for structure work in 22 projects. The total of all structures in this budget year that were advertised and placed under contract, in 181 projects, was $146,575,000.

Metropolitan Area Freeway Structures

In San Francisco the Clay-Washington ramps to the "Embarcadero" Freeway were completed. These ramps were integrated with the overall plan for the Golden Gate Gateway Redevelopment Project. A $5,000,000 contract for a portion of the Route 82 double- and single-deck viaduct between Newcomb Avenue and Army Street is close to completion. The completion of this section will allow the portion of the double-deck viaduct completed previously, from the Route 82/101 Interchange to Newcomb Avenue, to be opened to traffic; which, together with the new portion will provide freeway access to the Army Street-Third Street area of San Francisco.

In San Mateo County work has been completed on the construction of 10 major grade separation structures on the first section of Interstate 280 (Junipero Serra Freeway) south of San Francisco. Included in this project is a three-level intersection at the 280/1 Interchange.

In Alameda County work continues on construction of the nine bridges to carry Route 680 between Dublin and the Contra Costa County line. The 325-foot-long steel deck-plate superstructure of orthotropic design used on one of these bridges in attracting international interest. It is one of the first bridges of this design to be completed in this country and considerable technical research has been done during its construction.

In Contra Costa County, work is just getting underway on the five bridges for the Franklin Canyon Freeway, Route 4, between Martinez and Cummings Skyway.

At the Caldecott Tunnel, on Route 24 between Alameda and Contra Costa Counties, construction is nearing completion on the new system of approach roadways incorporating intricate lane control equipment.

The reconstructed Eel River Bridge at Rio Dell was opened to traffic in May 1965. (See next photo.)

In the Sacramento metropolitan area work is in progress on two contracts on 29th and 30th Streets, (Routes 99 and Interstate 80). Structures on these projects have received national recognition, due to aesthetic design, and have been featured in technical and trade magazines. The portion of Interstate 80 between A Street and Arden Way is being widened to provide three lanes of traffic in each direction.

Construction of the Interstate 80 freeway along W and X Streets in Sacramento is in the initial stages.

The Eel River Bridge at Rio Dell after it was washed out during the December 1964 flood. (See previous photo.)

The $12.7 million, eight-lane Interstate 80 freeway bridge crossing the Sacramento River is about 50 percent complete. Operations included the driving of 5,000 foundation piles and erecting huge 275-foot steel girders over the Sacramento River. Current work includes construction of the concrete roadway deck and connection of the bridge with Interstate 80 in Yolo County.

The first project on the 2nd-3rd Streets Freeway, Interstate 5, started in late 1964. Structure work consists of a grade separation structure on Capitol Mall which will eventually span the depressed section of the freeway.

Structures along the Santa Monica Freeway in Los Angeles were completed and opened to traffic from the Harbor Freeway to a point west of the San Diego Freeway. The remaining structures along the Santa Monica Freeway are completed and when this section is opened to traffic in the early fall will provide the first complete east-west freeway in West Los Angeles.

All structures on the Pomona Freeway were under construction from the East Los Angeles interchange to east of Workman Mill Road in the City of Industry.

Structures along the San Gabriel Freeway were either completed or under construction from the San Bernardino Freeway to the San Diego Freeway.

Bids were received for the first structure contracts along the Foothill Freeway in the San Gabriel Valley.

Construction work continued at a high tempo on Interstate 5 in San Diego. Four contracts with 21 structures were completed during the year and there are six major contracts with 36 structures now underway.

Other Major Projects

Two bridges were completed over the Sacramento River along with an underpass and two overcrossings of the Interstate Route 5 Bypass of Red Bluff.

Completed during the past year, were 15 structures on the Modesto Freeway.

In a contract between Cisco and Hampshire Rocks on Interstate Route 80, 14 structures were constructed. Also on Interstate 80, 17 structures in Solano County near Vacaville were completed and opened to traffic.

During the 1964–65 fiscal year, the structures on two widely separated Redwood Highway freeways were completed. Eighteen reinforced-concrete bridge and interchange structures were completed on the City of Ukiah Bypass in Mendocino County, and 13 reinforced-concrete girder bridges and interchange structures were completed on the McKinleyville Freeway in Humboldt County.

The Klamath River south span repairs shortly after the bridge was opened to traffic in March 1965. The span was washed out during the December 1964 floods. Contractor's crews are completing the timber sheathing of the pile bents to protect them from floating debris. (See next photo.)

The Klamath River Bridge looking north at the remains of the town of Klamath on December 30, 1964. Note the debris that has collected in the supporting members of the bridge. The large log leaning against the side of the bridge weighed about 30 tons. (See previous photo.)

In San Mateo County on Interstate 280 there are three contracts underway, including 12 grade separation structures designed with the new special architectural look to blend with the scenic area in which they are located.

The new structure over the Colorado River on Interstate 40 near Topock is well underway. Three other contracts in the vicinity of Needles are scheduled for construction during the 1965–66 fiscal year.

On Interstate 10, between Indio and Blythe, 14 structures were completed in the first unit, and two additional units are underway in the construction of the full freeway across the desert.

Two overcrossings were completed over Interstate 15 near Victorville.

Eighteen structures between Cronese Valley and Baker have just been completed in a contract on Interstate 15 in San Bernardino County. This route is now a four-lane freeway between Barstow and the Nevada state line near Las Vegas. These new structures replace the last of the 87 timber bridges built on this road in the late 1920's and early 1930's.

The Klamath River Bridge, looking south, shortly after it was opened to traffic. The steel trestle with timber deck is visible at the far end. The famous bears at each end of the bridge survived the flood.

Seven new structures were completed on State Route 14, the Antelope Freeway, which is entirely on new alignment leading to the south edge of Palmdale. A recently awarded contract is now underway which extends the freeway through Palmdale toward Lancaster.

Flood Damage

The floods in the northern part of the state, which occurred during December 1964, caused structural damage to 38 bridges on the state highway system. At 21 of these bridges one or more spans were washed out. At 14 major structures the spans which were washed out were from 100 to 300 feet in length. Cost of the bridge damage is estimated at $15 million.

Major damage was caused to four bridges on US 101, three across the Eel River near Scotia and the other across the Klamath River. On US 199 from Crescent City to the Oregon border, three bridges across the Middle Fork Smith River were seriously damaged. The structures on Route 96 from Willow Creek to its junction with Route 5 suffered the greatest damage. Washed out were bridges across Willow Creek, Klamath River at Orleans, Salmon River at Somesbar, Dillon Creek, Clear Creek and Indian Creek. The bridge at Canyon Creek on US 299 at Junction City was washed out as were two culverts and the resulting gulleys had to be spanned with temporary bridges. A steel girder bridge across North Fork American River on Route 49 near Auburn was destroyed when an upstream dam gave way. Other bridges washed out or seriously damaged were across Cold Creek on Route 20 and South Fork Eel River at Dyerville on Route 254. Numerous other bridges at various locations throughout the northern part of the state suffered some damage.

To expedite the required repair work, 23 emergency contracts were negotiated to reconstruct or replace the damaged bridges with temporary structures. Permanent reconstruction was made at three bridges, three temporary Bailey bridges were erected, trestles were constructed at five locations, log bridges placed at five sites and repairs made to seven bridges. In addition, 12 temporary log bridges were constructed by maintenance forces.

Contracts for the permanent reconstruction of all damaged bridges have been awarded and work is now either underway or has been completed.

Bridge Maintenance

Periodic field investigations were made of the 8,261 bridges on the state highway system. Capacity ratings for all structures were reviewed and kept up to date and the replacement of structurally critical bridges was scheduled.

The maintenance section initiated a project to apply an epoxy coating to 34 bridge decks located on or crossing over Interstate 80 at the higher altitudes. The top surfaces of the concrete decks had disintegrated, some severely, as a result of frost action, abrasion by tire chains and the heavy applications of salt applied during the winter for deicing purposes. The coatings should result in a significant reduction in maintenance and an increase in the deck life.

On February 5, 1965, a sand barge ran aground in the channel under the opened lift span of the bascule bridge across Sonoma Creek on Route 37 west of Vallejo. Settlement of the barge against the bascule rest pier at low tide caused considerable damage to both the pier timbers and the protective fender system. Repairs were completed by state maintenance personnel in July 1965.

On March 26, 1965, an overheight load struck and extensively damaged the girder and bridge deck of the Indian Avenue Overcrossing on Interstate 10 in Riverside County. All work was completed on July 12, 1965, under emergency contract.

The Bridge Maintenance Section made engineering investigations at the request of local authorities for 85 city and county bridges to establish their load-carrying capacity. Fourteen public hearings were held to consider speed and load posting for these bridges.

Bridge Maintenance Painting

A new paint system, developed by the Bridge Department and the laboratory, was applied to the sign bridges. This work, done in cooperation with District 1 maintenance department, provided an excellent opportunity to assemble cost data and to ascertain the most efficient procedures for similar work throughout the state when needed.

As a result of this Bridge Department experimental paint program the service life of paint on coastal bridges will be more than doubled.

. Personnel & Information

PERSONNEL

Continued growth of the highway program increased the total personnel of the division by 819 during the fiscal year to a total of 17,604. This includes 9,064 engineering staff, 4,156 maintenance employees, 630 right-of-way agents, 383 equipment repair employees, and 3,371 in administrative services, accounting and clerical classes.

Recruitment

Nationwide recruitment tours still are being conducted to attract graduate engineers to state service. Examinations are scheduled for graduates in California colleges. Other state agencies participate in this program which is coordinated by the State Personnel Board. As a result, 126 engineering graduates were hired from out of state and 91 from California schools during the past year.

Because of a shortage of engineering candidates for the Los Angeles area the State Personnel Board conducted a special nationwide recruiting tour during the fall of 1965. Prospective applicants for both the classes of junior civil engineer and assistant engineering specialist (highways) were interviewed.

Personnel Management

A new class of highway equipment mechanic apprentice was established along with a program of full apprenticeship training.

By joining the neighborhood youth corps program of the Stockton Unified School District, the Division of Highways is providing work experience training for high school dropouts under the federal government's "War on Poverty." Twenty-two trainees were assigned during the spring of 1965 to work with our regular crews in highway and landscape maintenance and reproduction activities. The trainees did effective work which stimulated a helpful interest on the part of the crews with which they are working.

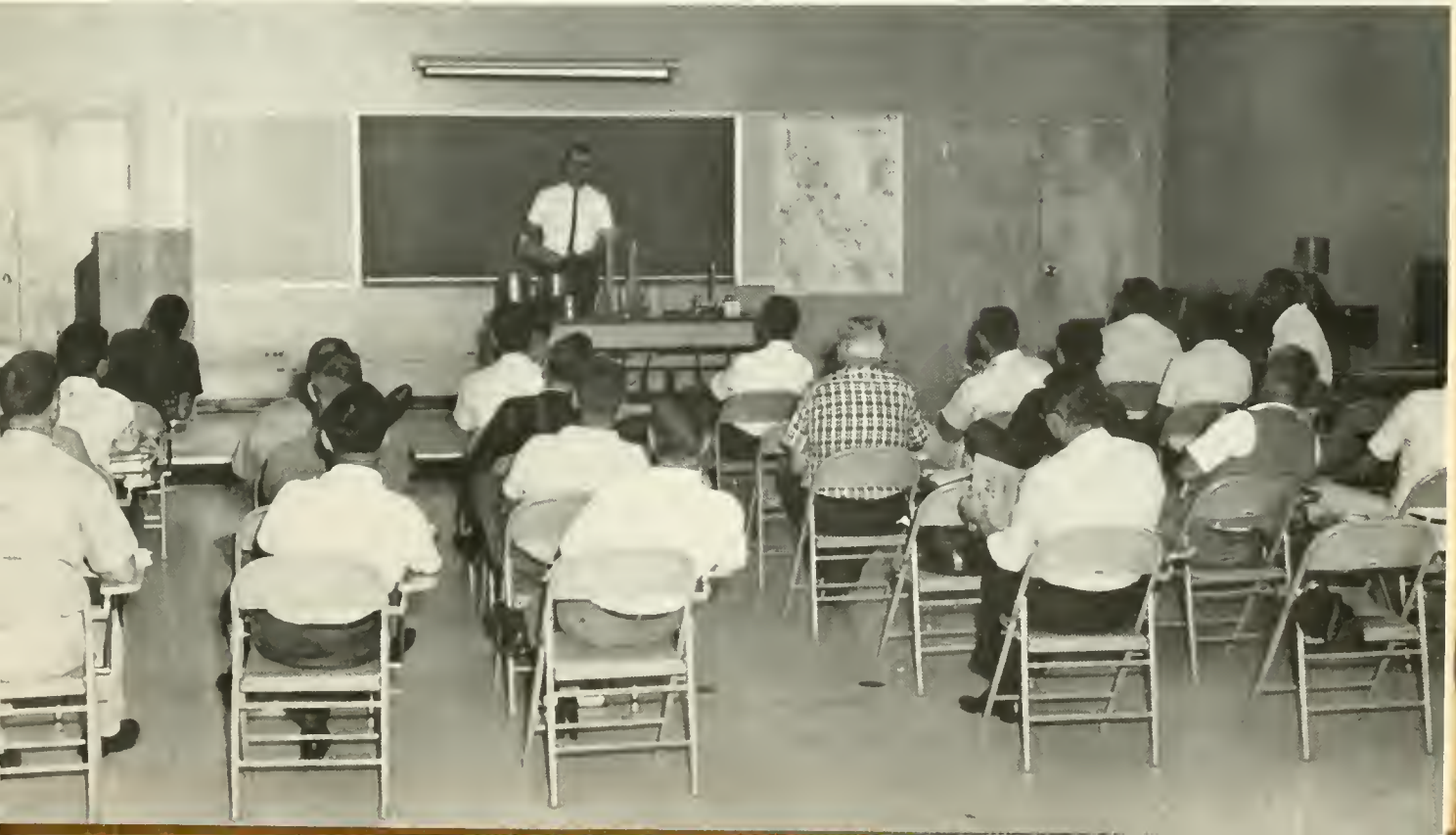
The Stockton youth trainee program will be expanded and other areas of the state may be included during the 1965–66 fiscal year. The division also plans to carry on similar cooperative projects with county welfare departments under the community work and training program.

Statistics

During the current year, 22 employees were dismissed—13 from permanent positions. Twenty-two were rejected during probation, three were demoted, and 48 were suspended. A total of 181 employees retired. Forty-three 25-year awards were given.

Three hundred thirty-nine visitors from 33 countries visited the division generally under the auspices of federal government programs and coordinated by the U.S. Bureau of Public Roads. Discussions and training programs were arranged for each individual or group.

Construction personnel are given training in the performance of construction control tests to insure that proper techniques and procedures will be followed on the job.



TRAINING

Training activities in the Division of Highways have two purposes: to improve the manner in which employees carry out the highway program; and to provide them with a reservoir of skills needed to cope with the highway program of the future.

IN-SERVICE PROGRAMS

Organizational Development

Programs to increase productivity, efficiency and flexibility of the division include study and improvement of communications, internal and external relationships, employee attitudes, motivation and morale, management and supervision, internally caused recruitment problems and turnover, employees relationships to systems and procedures, future demands for trained personnel, present and anticipated employees' potential to fill them.

Organizational development activities also include a continuing training program in the Fiscal Management Department, the Bridge Department and the Computer Systems Department where changes in computer capabilities have had a tremendous impact.

Management Development

Under civil service, employees rise through the ranks to fill almost all high-level division positions. College graduates, first employed as junior engineers or right-of-way agents, gain experience and are promoted by examination to higher levels. At the third or associate level they supervise others. At the sixth or principal level they are in charge of districts or have headquarters staff responsibilities for major programs.

The majority have technical, rather than management educations. Through the division's management development curriculum, they acquire needed supervisory, administrative and management skills. Employees begin a series of supervisory workshops when they reach the third level, and continue to take special programs as they climb the career ladder. Participation is automatic.

A major gap in this management development curriculum closed when we held the first Highways management conference this spring. Employees who pass examinations for sixth-level positions attend an intensive 40-hour conference, where they examine highway operating policies, problems, goals and objectives. In this manner we help employees newly promoted to decision-making levels to maintain a continuity of purpose and effort in implementation of the highway program.

Employees from the fifth or supervising level up participate in the state's interagency management development program, which comprises courses and conferences designed to improve managerial efficiency. Eligible employees and their supervisors determine which courses each employee most needs. To assure that overall division objectives are met, nominations are centrally coordinated. We have evaluated the courses carefully to determine which best fit our requirements.

Equal Opportunity

The division has always been nondiscriminatory in its personnel practices. However, because of increased nationwide focus on equal opportunity regardless of race, creed or color, and the Governor's strong leadership in this area, it was decided to emphasize this position. All fifth-level employees participated in workshops designed to eliminate misconceptions about minority groups, explain policy and show how it applies in practice. The result has been intensified support for equal opportunity among employees responsible for hiring and promotion.

Employee Training

Division training helps give employees the skills and knowledges needed to perform effectively and to apply technological advances in their work.

For example, the division's two-year rotation-training program for junior civil engineers speeds the new engineer's application of his civil engineering education to highway activities.

With right-of-way agents a different problem exists: The basic requirements of their jobs are not covered by college courses. The division holds an annual two-week right-of-way academy to introduce new agents to basic right-of-way skills. Coupled with planned job rotation, this helps assure effective performance in their new careers. As agents are promoted, they are given advanced training, usually after working hours, through contract with the University of California.

To continue the inspector training started last year with "portland cement concrete inspection," an "asphalt concrete inspection" course was given to all construction personnel. These programs, periodically repeated, help insure that inspectors are effective with both major types of highway surface.

Other technical and professional courses conducted by the division were "traffic signal controls" and "engineering uses of electronic data processing" covered technological change. Others, such as "mechanical features of equipment operations" and "radiological monitoring," promoted the safety of employees and equipment. A few, including "traffic forecasting and estimation," were done under contract by the Institute of Transportation and Traffic Engineering, University of California.

With respect to nontechnical training, supervisory programs for first-line clerical and highway maintenance supervisors neared realization when courses for both groups were developed and tested.

Many bay area residents have been interviewed by Bay Area Transportation Study Commission employees surveying transportation needs. To assure that interviews were conducted effi-

iently, with minimum public inconenience, a weeklong course was used oth to train interviewers and to creen out those who did not show ufficient skills.

Continuing efforts to improve writen communications to the public, effective letter-writing clinics" were held for supervising engineering personnel.

OUT-SERVICE PROGRAMS

In some subjects, it is more efficient to use existing university short courses and workshops. Sparked by spectacular technological advances, this type of training plays an increasingly important role. This year, 72 employees participated in such courses at state expense. Examples are "abstracting and coordinate indexing," "non-destructive testing," "statistical quality control methods," and "urban transportation planning processes."

SAFETY

The Safety Section has one prime bjective: to keep every division emloyee safe and sound and on the job.

To accomplish this it uses a variety f devices: safety posters, films, emloyee safety meetings, periodic inpections for unsafe conditions, and roviding employees with necessary rotective equipment.

Characteristic of the new tasks being ssumed by the Safety Section is one n regard to nuclear soil gages now eing used on construction jobs by the)ivision of Highways to test the denty and moisture content of earth fills.)istrict representatives using radioacve isotopes in testing procedures and ne district safety supervisors have reeived special training by the Materials nd Research Department.

The Safety Section has the responbility to monitor working conditions n this program.

There has been a generally continuus reduction in frequency rates of inustrial injuries and motor vehicle acidents since the Safety Section was stablished in 1941. The frequency rate as been reduced from 22.08 in 1953 o 8.66 in 1964. The frequency rate or motor vehicles has been reduced rom 1.00 in 1953 to 0.55 in 1964.

There are few significant changes in ne motor vehicle accident rate in the ivision within the last four years. One f the most serious problems has been ccidents and injuries resulting from quipment backup. Backup warning evices are being installed on all trucks f two-yard capacity or greater, and n those vehicles with limited visibility.

During the past year a color motion icture for maintenance crews entitled, TCLCM" (The California Lane Clore Method), developed by the Safety Section, was produced by the Audio-Visual Section at Headquarters.

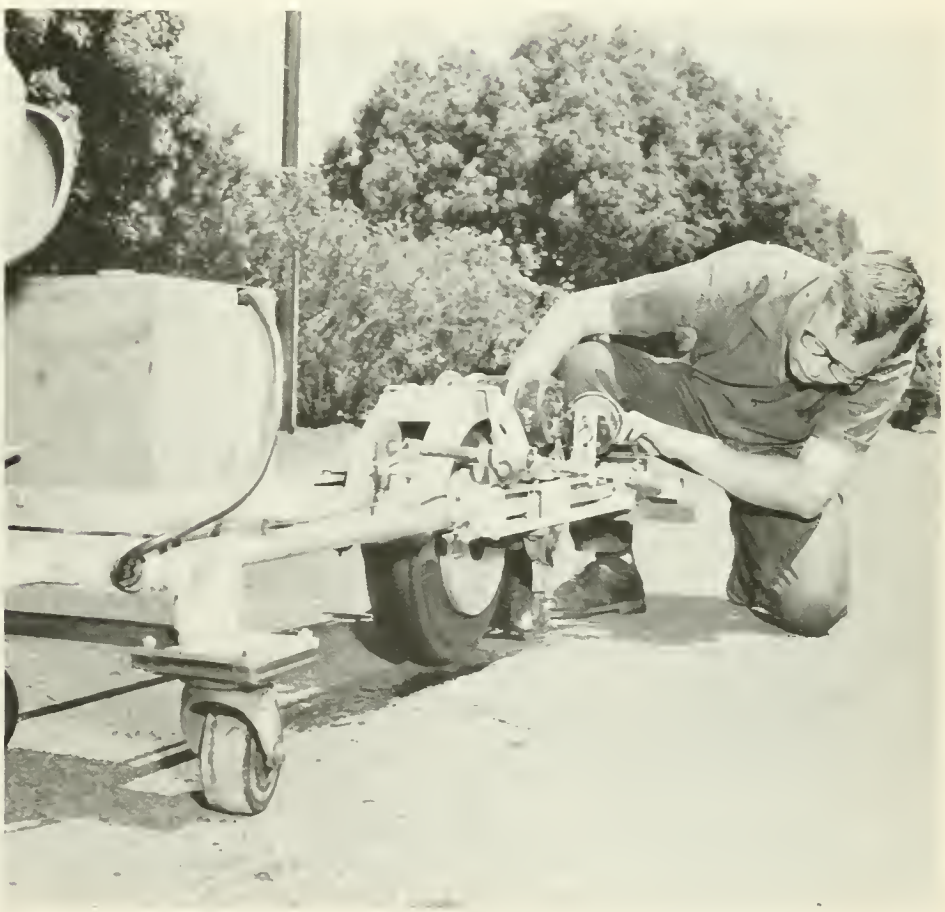
Purpose of the film is to demonstrate the recommended policy for lane closure methods on various types of highways and to establish uniformity for work area protection throughout the state.

Employee Suggestion Program

The Division of Highways employee suggestion program is administered by the Headquarters Safety Section. The section also coordinates that portion of the employee suggestion program which provides recognition for special acts, special service and superior accomplishment.

Suggestions submitted during fiscal year 1964–65 totaled 402. Other figures on the program were as follows:

Certificate of commendation	8
Suggestions based upon intangible savings	14
Number of money awards	28
Amount of money awards	$1,710
Estimated savings	$12,588



A Division of Highways technician operates the California skid tester. The device can be used in safety studies to evaluate the friction between a rubber tire and a wet pavement surface.

AUDIO-VISUAL

The Audio-Visual Section originates and produces a wide variety of graphic material and films for use in employee training and public information.

The section maintains a comprehensive library of colored slides and movies on statewide highway scenes, conditions, and operations. It also maintains a variety of film, slide projection, sound recording, and other miscellaneous equipment for departmental use for training or public presentations.

In 1965 there has been an increasing emphasis on motion pictures for personnel training and information. This section has furnished many tape and motion picture clips for radio or TV use to illustrate a variety of highway activities and conditions.

Revisions have been made to 16-mm. motion pictures on "Freeway Traffic Flow" and "Balboa Park Landscaping," both of which should be available by late 1965. Work is underway on "Work Area Protection," a training movie on lane closure methods to protect maintenance crews working on the roadway; "Design Aesthetics," a training movie for highway designing personnel; "Wrong-way Driving," a training and informational movie on results of a research project on wrong-way driving at freeway off-ramps.

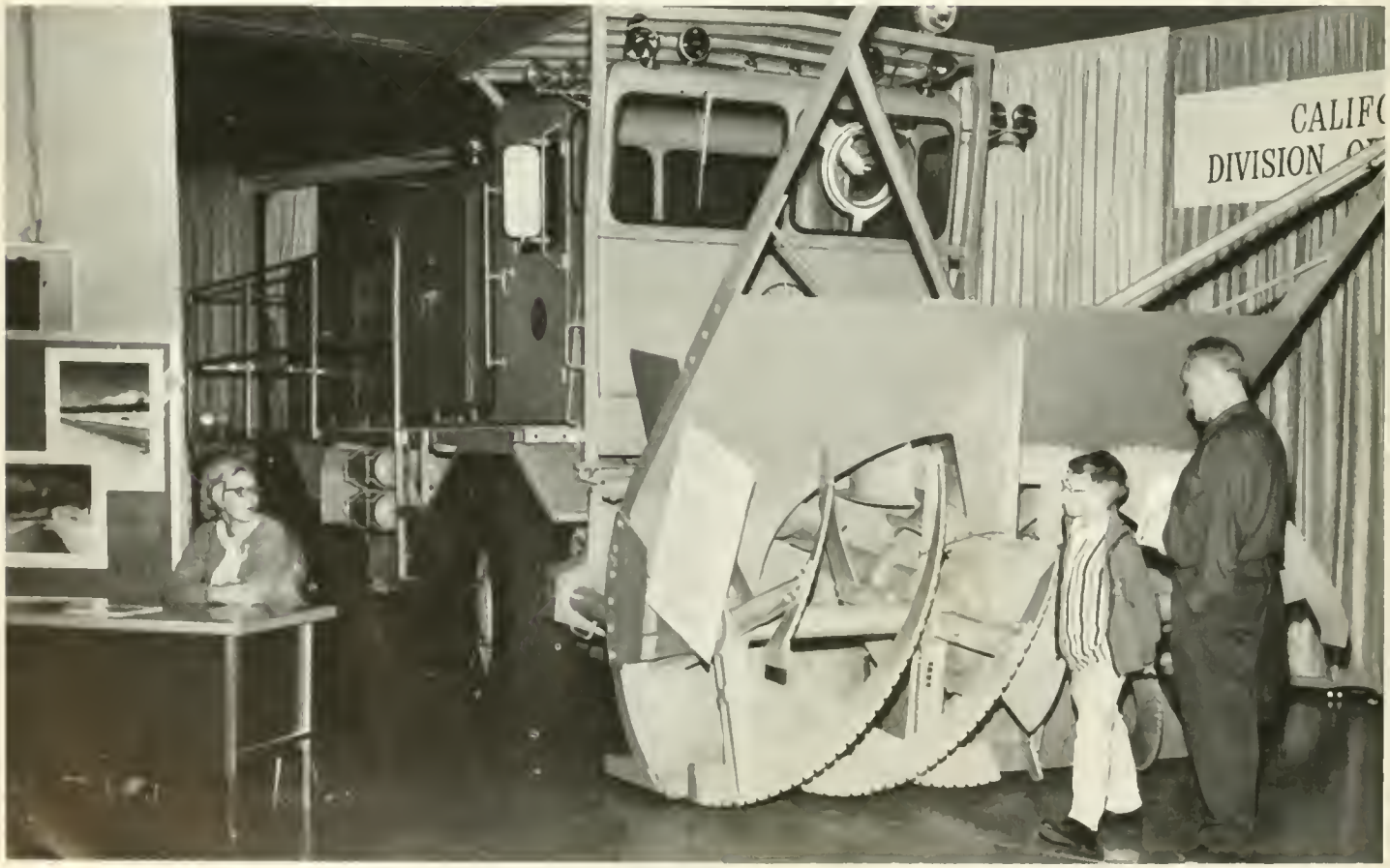
PUBLIC INFORMATION

Although traffic safety was of as great interest as it has been in the past, both the press and the public at large this year displayed an increased and constructive curiosity in highway projects where aesthetic values can be integrated into the finished product.

Roadside rests, scenic highways, landscaping and multiple uses of airspace over and under freeways were of particular interest to all because of their high adaptibility. But perhaps the keynote was sounded in a telegram sent by Mrs. Valley Knudsen, president of Los Angeles Beautiful, to Administrator of Transportation Robert B. Bradford on July 20. The occasion was a meeting of city, county and state officials called together by Bradford to study the concept of using airspace over and under freeways for additional productive purposes.

Aesthetic Values

Mrs. Knudsen said in part: "Los Angeles Beautiful hopes that your discussion on July 20 will be concerned not



Assistant Information Officer Marcia Mickelsen (seated, left) staffs the Division of Highways exhibit at the Winter Sports Fair in San Francisco. The exhibit featured one of the division's new 19-ton, 50-foot-long rotary snowplows which can throw up to 2,200 tons of snow an hour.

nerely with the economic and engineering aspects of the use of airspace over freeways, but also with those human needs and aesthetic values which the parklike open space of landscaped freeways provides our increasing urban populations.

"We realize each proposal must be judged on its individual merit. But as California now leads the national trend toward beauty in freeway and scenic road design, we hope this same philosophy will be a strong factor in judging proposals that come before your office and the many local agencies which are concerned."

The state's first *complete* safety roadside rest was opened to the public in July. Located near Red Bluff, it received statewide attention in the press and was lauded for the manner in which it blends into its environment.

Also acclaimed was the selection of Route 1 in Monterey County between the San Luis Obispo county line and the Carmel River as our first official "scenic highway." This action was taken by John Erreca, Director, State Department of Public Works, upon the unanimous recommendation of the State's Advisory Committee on the Master Plan for Scenic Highways.

Research in the field of traffic safety was given special mention in one of Governor Edmund G. Brown's televised press conferences. Public response was so great that the full-time services of two persons were required for a 10-day period just to answer letters the program elicited from private citizens.

Wrong-way Drivers

Almost equal response was derived from a series of four articles (see May–June 1965 issue) that described wrong-way drivers and another that told of experiments with "talking highways"—an electronic system capable of relaying warnings and messages to drivers (see July–August issue).

Perhaps the peak effort of the information staff was providing the nation with up-to-the-minute news from northern California where last winter's floods wrought massive destruction. Daily reports were made from the scene until emergency workers had repaired highways to the degree that traffic could use them once again.

The tempo that began in 1959 in regard to the opening of important new freeways and other highways was maintained and drew the normal share of public attention. The number of such openings increased during National Highway Week. Although dedication ceremonies were planned and conducted by local organizations, district offices assisted by supplying information and sketch maps to the news media.

The number of news releases announcing bid advertising and opening, contract awards, speed zones and construction progress increased over previous years.

Greater emphasis was placed on visual displays. Several districts participated in county fairs and District 3 joined with headquarters in such a project at the State Fair. Districts 7, 8, and 11 sponsored a joint exhibit at the Los Angeles County Fair during National Highway Week.

Motion Pictures

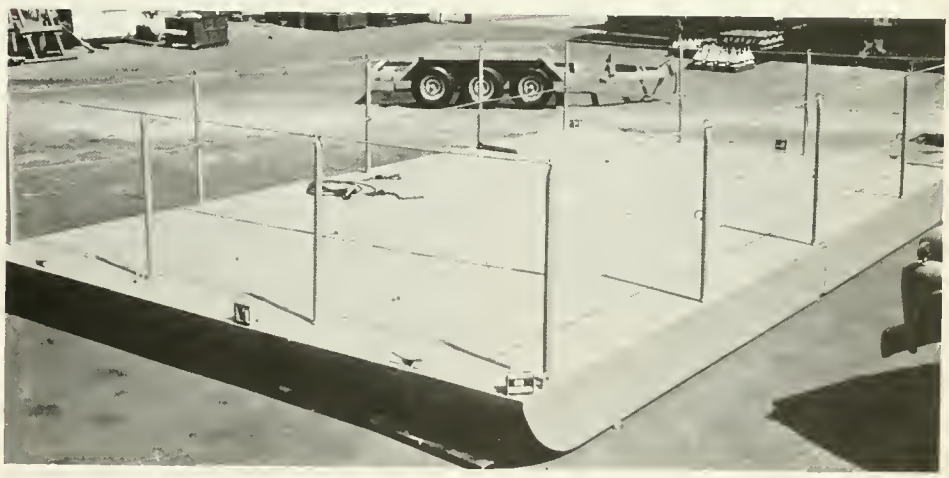
Motion pictures also were important. The script for the film *Heritage* was produced in the information office. *Heritage* was a joint venture of the Departments of Architecture, Parks and Recreation, and the Division of Highways. It depicts the restoration of some of California's first buildings and "ghost towns." The division also participated in producing a 30-minute film on the northern California floods. Several clips on varied subjects were produced for television newscasts and were distributed on a statewide basis.

The principal publication of the Division of Highways, *California Highways and Public Works*, continued to serve as a vehicle of general and technical information. As in the past, it was in great demand by engineering schools, libraries, Department of Public Works employees and the general public.

Several reprints derived from it were of special interest, and numerous other magazines, trade journals and newspapers were granted permission to reproduce material from it. Black-and-white glossy prints of illustrations that accompanied articles were in great demand and requests from editors and free-lance authors from all parts of the world were received and filled.

Each district office publishes employee bulletins on a monthly basis. Local information was furnished to them through the "clip sheet" that originates each month within the information office.

Guest speakers were provided to service clubs, civic groups, chambers of commerce and similar organizations throughout the year. Senior officials of the division also appeared on television and radio in newscasts and programs concerned with state highways.



The portable floating drill barge is one of the latest pieces of equipment developed by the Division of Highways.

Legal

The following tabulations indicate the volume of work performed by the Legal Division involving court appearances and appearances before various administrative agencies for the past year.

Condemnation Proceedings

Some idea of the volume of the condemnation casework is given by the following tabulation:

Suits filed	411
Parcels involved	2,110 *
Defendants involved	13,853
Suits closed	505
Contested trials	266
Uncontested judgments	280
Default judgments	25
Suits pending 7/1/64	848
Suits pending 6/30/65	754

* The parcel count is based on a count of parcels filed on as described in condemnation resolutions.

The total suits closed, 505, represented total awards of $21,114,247.77, and represented 1,233 days in court.

Appellate Cases

More appellate decisions were rendered during the fiscal year than in prior years, both in condemnation proceedings and in public liability actions against the department. The condemnation cases decided were *Peo. v. Fair*, 229 Cal. App. 2d 801; *Peo. v. Elsmore*, 229 Cal. App. 2d 809; *Peo. v. Kawamoto*, 230 A.C.A. 18; *Peo. v. Glen Arms Estates, Inc.*, 230 A.C.A. 912; *Peo. v. Dickinson*, 230 A.C.A. 1002; *Peo. v. Miller*, 231 A.C.A. 166; *Swartzman v. Superior Court*, 231 A.C.A. 230; *Peo. v. Donovan*, 231 A.C.A. 382; *Peo. v. Bond*, 231 A.C.A. 486; *Peo. v. Graziadio*, 231 A.C.A. 581; *Peo. v. Garden Grove Farms*, 231 A.C.A. 713; *Peo. v. Donaldson*, 231 A.C.A. 813; *Peo. v. Quinones-Quintana*, 231 A.C.A. 860; and *Peo. v. Malone*, 232 A.C.A. 667.

The legal issues involved on these appeals included a determination of the extent of the larger parcel *(Fair, Dickinson)*, the use of purchases by the state as evidence of market value *(Kawamoto, Donaldson)*, whether staff or independent appraisal reports are within the attorney-client privilege *(Glen Arms, Donovan)*, severance damages and special benefits *(Elsmore, Bond)*, Discovery *(Swartzman)* and the admissibility of offers of settlement *(Graziadio)*.

A most significant decision was rendered in *Peo. v. Garden Grove Farms, supra*, upholding the validity of Streets and Highways Code Section 104.2 and authorizing the department to condemn private property for purposes of exchange for school district property needed for a freeway.

In the public liability area, decisions were rendered in *Zeppi v. Beach*, 229 Cal. App. 2d 152; *Flournoy v. State*, 230 A.C.A. 579; *Hayes v. State*, 231 A.C.A. 73; *Hilltop Properties, Inc. v. State*, 234 A.C.A. 101; and *County of Los Angeles v. Superior Court*, 62 A.C. 889.

It was mentioned in the last annual report that the *Flournoy* and *Hayes* cases were pending to determine the constitutionality of the 1963 California Tort Claims Act, which regulates the tort liability of all governmental entities. These cases have now been decided and the validity of the new law was upheld by the district court of appeal.

In the first case on this subject to be heard by the Supreme Court, the department appeared as amicus curiae in support of the County of Los Angeles. The new law was ruled constitutional and fully retroactive to pending actions in a unanimous opinion of the Supreme Court in *County of Los Angeles v. Superior Court, supra*. The Flournoy case was cited with approval and the law is now settled in favor of public entities.

The decision in *Zeppi v. Beach, supra*, has finally put an end to litigation which commenced with an automobile accident in Butte County in February of 1957. After three different appeals *(Zeppi v. State*, 174 App. 2d 484; *Zeppi v. State*, 203 Cal. App. 2d 386; and the present decision), it was determined that neither the state nor two highway maintenance employees sued individually were liable for any damages resulting from the accident.

Other Litigation

In addition to the condemnation proceedings, the department's attorneys handled a large number of miscellaneous cases. The following figures cover a wide variety of litigation and indicate the immense increase in this phase of the department's work during the fiscal year 1964–65:

Cases pending	847
Filed during 1964–65 fiscal year	920
Total being processed	1,767
Cases closed	776
Cases pending 6/30/65	991

Some of these cases involve claims for damage to state highway facilities, such as bridges, signals, guardrails, or damage to state vehicles, also unlawful detainer actions. During the fiscal year collections from these cases by the division amounted to $129,486, an increase of $13,955 over the amount collected in the previous fiscal year.

The case total includes many cases where the department was represented as a defendant, such as inverse condemnation, suits by contractors for additional compensation on construction contracts, proceedings for damage to public property by reason of the state highway operations, and suits filed because of alleged dangerous or defective condition of state highways, and suits for injunction against the state and its contractors enjoining the construction and building of highways. Other types of suits, such as stop notice actions, are defended by the department, and interpleader actions have been filed by the department in which it assumes a neutral position between the contractor and the party suing on a stop notice.

Proceedings Before Public Utilities Commission

The division handles matters before the Public Utilities Commission

having to do with crossings of grade at highways and railroads and the construction of grade separations. The following tabulation indicates the volume of work handled by the division in this category:

Fiscal Year 1964–65

Applications pending (decisions not issued) 6/30/64	8
Applications pending (decisions issued) 6/30/64	27
New applications filed during year	30
Total applications before Public Utilities Commission	65
Decisions received during year	54
Applications pending 6/30/65	11

In addition to formal applications, six proceedings under PUC General Order 88, relating to crossings at grade, were processed, making a total of 12 on file. In all instances, the approval of the Public Utilities Commission must be obtained as to engineering details and, in the event of a failure to reach an agreement with the railroad involved as to apportionment of cost, the applicant seeks such determination by the Public Utilities Commission.

Board of Control and Other Claims

Claims against the state by reason of activities of the department are filed with the State Board of Control.

The following tabulation illustrates the increase in the volume of work handled by the department's attorneys before the Board of Control:

	No. of claims	*Amount*
Pending on 7/1/64	42	$2,052,267.04
Filed	470	43,377,952.72
Total	512	45,430,219.76
Claims disposed of	403	37,266,794.47
Pending 6/30/65	109	8,163,425.29

There was an increase of 83 claims filed over the previous year, amounting to $15,434,865.36. This was an increase of 21½ percent. The principal types of Board of Control claims as listed above are for negligence, dangerous or defective condition of state highways, breach of contract and inverse condemnation.

The continuing increase in the number of claims filed with the board is due in a large part to the decision by the California Supreme Court in the case of *Muskopf* v. *Corning Hospital District*, 55 Cal. 2d 211. This decision greatly expanded the liability of the state, particularly for accidents arising out of the dangerous or defective condition of state highways. The 1963 session of the Legislature enacted Chapter 1681 which expands the liability of the Department of Public Works. The legislation makes the state liable for the negligent acts or omissions of its employees as well as for the dangerous condition of public property, including state highways. This liability will necessitate the careful investigation by Division of Highways personnel of all claims. Because of the *Muskopf* decision and this legislation, the number of claims have increased substantially as well as the work in investigating these claims and the handling of the resulting litigation.

Samples of traffic lights are tested at accelerated rates in this aging rack to see if they meet bulb life requirements. Longer and uniform life means less maintenance cost and greater safety to the motoring public.

FOREIGN VISITORS. French engineers inspect fanroom controlling ventilation in the Caldecott Tunnel.

Contractors' claims before the State Highway Engineer's Board of Review for additional compensation have increased notably. These claims have required considerable work, both in the analysis and handling of claims as well as the resulting litigation. Directly proportional to the number of Board of Review hearings is the increased number of lawsuits against the department arising out of construction contract claims.

House Counsel Work

The "house counsel work" of the division has also shown a decided increase. This work consists of legal opinions directed towards preventing litigation rather than engaging in litigation after damage has occurred.

Other routine work has increased, such as approval of contracts and leases, reviewing forms and accident reports. This work is directly proportional to the increased volume of the highway program. In addition, there were 31 contested hearings before the State Personnel Board.

. Right of Way

For more than 100 years people have been rushing to California in ever-increasing numbers. By this time tomorrow nearly one thousand more will have arrived. In a year they will fill a city larger than the state capital—Sacramento.

What must be done to accommodate the new arrivals? In part, more homes and jobs will be needed to shelter and support them. California's potential productivity and wealth will be increased by their many talents. Moreover, California's highway builders will have to produce more and better highways to move them from home to work, home to store, and home to recreation.

The Right of Way Department plays a very important role in the production of more and better highways. This department will provide the land on which the highways will be built. In an environment of explosive population growth and land development the task is difficult and complex.

Right-of-way work is characterized in part by its many special performance areas such as right-of-way engineering, appraisals, acquisition, utility relocation and property management. The brief tabulation below illustrates the magnitude of this work. But it is more than a series of separate tasks. It is a complete service. Some of the less known facets are contributing more and more to the whole Right of Way product.

1964–1965 RIGHT-OF-WAY PROGRAM

Volue of parcels acquired		$166,767,433.44
Number of parcels acquired	8,533	
Average value per parcel	$19,543.82	
Utility relocation payments		$13,334,668.48
Acquisitions far other agencies		$6,157,566.97
Total expenditures		$186,259,668.89
Receipt from sales and rentol income		$12,249,428.95

Three such functions are: relocation assistance, right-of-way estimating and airspace management. Each has for sometime been part of the Right of Way process. Each has, in the past year, become more important as a factor in the total Right of Way service.

Relocation Assistance

When the Right of Way Department buys a man's home and he wants help finding a replacement, the department provides help. This process is called relocation assistance. In past years property owners displaced by highway acquisitions have been assisted on an informal basis. Help came from the state acquisition agent. For example, an elderly couple might be furnished a ride so they could look at a replacement cottage, or a groceryman might be put in touch with a number of local commercial realtors who know of stores for sale. Help was furnished whenever property owners indicated a need.

More recently relocation assistance has become more extensive and more formal. Where, in past years, assistance was primarily for property owners, the recent trend has been toward providing tenants with the same service.

A small, but very important, part of the Right of Way staff now works full time assisting both owners and tenants to find replacement farms, homes, and businesses. Where the demand warrants, separate project offices have been opened to handle the relocation program.

Until mid-1965, relocation followed its historical trend of providing *service* only. However, in 1965 the California Legislature passed a bill which provides that people displaced by highway property purchases, will be compensated for their moving costs.

Payments will vary depending upon the type of property involved and the amount of belongings which must be moved. However, payment may not exceed $200 for residential and $3,000 for business-type properties. Both tenants and owner occupants are eligible for moving cost payments.

Relocation assistance has evolved from an informal help-your-neighbor activity to a formal and fully devel-

What will lond cost be in five years? Future highway plans for this part of Santa Clara County will be based in part on the answer.

Construction was completed on the Pacheco Pass highway relocation. The highway is heavily used by trucks to link the farming areas of the southern San Joaquin Valley with the San Francisco area market.

oped Right of Way function. Evolution of this function has come about, in part, to provide a more complete Right of Way service.

Right-of-way Estimating

The headline, "Land Cost Exceeds Construction Cost" focuses attention on another activity of growing importance—right-of-way estimating. Right-of-way estimates are predictions of what land needed for a highway will cost. Traditionally, land cost, though sizable, has been much less than construction in total highway cost. But today this is no longer true. Land is becoming more scarce and more costly—particularly in the metropolitan areas.

For example, southern California's planned freeway network now includes projects where land costs are three times construction costs. Other parts of the state may look forward to the same circumstances—more dollars for land.

One result of California's near hysterical rise in land value is that tomorrow's highway locations will depend more and more on land costs. Therefore, in order to soundly plan for tomorrow, we must, today, more accurately predict what land costs will be.

This past year, a more comprehensive, estimating procedure was instituted. As a result, future property value estimates will be more valuable as tools for use in highway planning and in the route selection process.

Airspace

Today the term "space" suggests adventure, the unknown, great speed, daring, and profound technical advance. Man's exploration of space has been motivated by many things, among them: curiosity, military advantage, and perhaps anticipated need for more room for man himself. To the highway-minded, the term "airspace" has a similar flavor of adventure and daring. Its exploration too has been motivated in part by man's anticipated need for more room.

Airspace is the expanse above and below highways. It generates interest because land is a fixed, scarce, commodity. Where horizontal land development is no longer feasible, man must look up or down for more space. America's skyscraper is the product of man's upward glance.

The fact that modern highways occupy a relatively small amount of vertical space but considerable horizontal space suggests multiple use of the airspace. This is particularly true in areas where competition for land is high and development intense.

To date, use of airspace in California has been confined to development of auto parking lots under elevated highways. In other parts of the country, where conditions are different, several imaginative projects have been conceived and constructed. For example, in New York City a quartet of 32-story giants called the Bridge Apartments straddles the approach to the George Washington Bridge. In Detroit, Cobo Hall, a municipal government center, has been placed over a major interstate highway. In Illinois and Oklahoma restaurants bridge tollways at various locations. (The restaurant developments are based more upon unique location than upon a need for use of vertical space, therefore they illustrate a different motive for airspace use.)

In California more daring, diverse, development of airspace above and below highways is now being considered. Very soon some California highways will share their bit of earth with some other use—perhaps shop, school, home or hospital.

Summary

Recent Right of Way Department growth has paralleled the growth of California. With growth have come complex problems and progress. Until recently, providing land for highways was enough. Today it is not. Right of Way must now provide land and service. Illustrations of the service trend are: (1) relocation assistance—a service to those displaced by a highway; (2) estimating—a service to those who must plan and locate tomorrow's highways; (3) management of airspace—a service to provide more complete utilization of public land devoted to highways.

Fiscal Management

Accounting Systems

During the fiscal year ended June 30, 1965, sweeping changes were made in the division's budgeting, cost analysis, and reporting procedures. The goal was to obtain more significant information for management decisions, while reducing the cost of clerical and other labor required to produce that information. These changes included the following:

1. The production of the first computer-prepared management cost reports for the division.
2. Reduction of the number of activity codes by 176 from 242 to 66. (An activity code describes what a Highways employee is doing at any given time. Reducing the number of these codes saves each employee time in preparing his time sheet with attendant savings in accounting labor and computer machine time.)
3. Object codes were reduced by 101, from 170 to 69.
4. Total coding was reduced an average of 30 characters per accounting transaction, approximately 50 percent.
5. Of 300,000 monthly accounting entries, 50,000, or one-sixth, are now generated by the computer, saving accounting labor.
6. The approximately 17,000 employees of the division have been organized into approximately 1,550 cost centers to pinpoint source of costs and to facilitate budgeting and cost control. The supervisor of each cost center receives a monthly computer-printed report, with a detailed analysis of the costs incurred by his unit.
7. Higher levels of management receive summaries of reports for cost centers under their supervision.
8. All costs are collected under a six-digit expenditure authorization number, of which the first four digits remain the same for advance planning, design, right-of-way, construction engineering, and construction phases of the work. Thus, ratio analysis of costs will be facilitated in the future.
9. The first of three volumes of the new *Accounting Manual* was issued.

Training

A training and staff development committee was formed to develop a comprehensive, long-range plan to integrate high-priority current training, and long-range needs in order to produce a highly skilled staff of professional accountants.

The training conducted during the year included a series of middle management confer. These conferences consisted of six solid days and evenings of intensified training in leadership, in-

Fiscal Management conducted a series of middle management development courses aimed at strengthening leadership, individual and group communications and current accounting practices. Here, a class is in progress at the armory in Sacramento. The course lasted 70 hours, of which 30 was on the employees' own time.

dividual and group communications, and current accounting practices. Conducted off the jobsite and on an informal basis, this training reflected some of the latest concepts employed in private industry and upper level educational institutions.

Other courses conducted during the year included:

1. Fundamentals of computers.
2. Flow charting for fiscal management.
3. Fundamentals of manual writing.
4. Accounting for city and county cooperative projects.
5. Implementation of electronic data processing.
6. Right-of-way accounting procedures.

The training for the year concluded with an intensified training seminar for district accounting officers.

Budgetary Control, Toll Bridge, Aeronautics, Flood Relief and Other Special Accounting

"Southern Crossing Studies"

The 1965 State Legislature, by Senate Bill 695, authorized the Department of Public Works to study the feasibility of southern crossings of San Francisco Bay at two separate locations. $300,000 was appropriated from the unencumbered balance of the San Francisco-Oakland Bay Bridge Toll Revenue Fund as of December 31, 1964. (Revenue after that date is pledged by law to finance the Transbay Tube of the Bay Area Rapid Transit District.) Fiscal Management personnel devised and executed the necessary action to make the study funds available. The study is now being conducted by the Division of Bay Toll Crossings.

San Francisco-Oakland Transbay Tube

Under prior year legislation, the Department of Public Works is required to finance the cost of the Transbay Tube and Approaches from the bridge revenue earned after December 31, 1964, by the three southern bond-free bridges. The 1965 State Legislature, in Senate Bill 660, establishes a ceiling of $133,000,000 on state obligation, and provides for repayment to the state, of approach costs at the annual rate of $2,500,000, starting December 31, 1971.

Toll Bridge Insurance

Toll Bridges with bonds outstanding must be insured with commercial insurance companies against physical damage and loss of revenue in order to guarantee payment of bond interest, since these are revenue bonds which are not a general obligation of the state. In addition, the major bridges on which bonds have been retired, are also insured, in order to facilitate any rebonding of such bridges and provide a hedge against the high repair or replacement cost in the event of catastrophic damage. It has always been difficult to obtain adequate insurance for certain bridges designated as "target risks," especially the Bay Bridge. During the past year the insurance on the Bay Bridge was successfully increased in order to facilitate the forthcoming sale of bonds to finance the rapid transit tube. As of June 30, 1965, the total coverage on all toll bridges was $244,000,000. This insurance program is administered by the Comptroller, Division of Highways.

Flood Relief Program

When the devastating floods of December 1964 hit northern California, the Division of Highways was better prepared to cope with the complex problems of obtaining and administering emergency relief funds, because its Fiscal Management Department had published revised flood relief accounting instructions applicable to all state departments in August 1963. New legislation enacted by the 1965 Legislature, Senate Bill 268, provided a temporary 1-cent-per-gallon increase in the state gas tax for flood repair work (rescinded September 1, 1965, when the necessary $57,000,000 of flood relief funds had been obtained from a combination of the state gas tax and federal funds). Because Senate Bill 268 modified the flood relief law, the statewide emergency flood relief accounting instruction had to be substantially revised in 1965 to incorporate changes in the financing and allocation of funds. (SB 268 became effective March 31, 1965.) The role played by the Fiscal Management Department has not been solely that of financial watchdog and recordkeeper. This department has also assisted local agencies to submit necessary documentation to obtain all state and federal flood relief funds properly due them.

Investment of Funds

The income of the State Highway Fund and the various toll bridge funds is received unevenly, while expenditures also fluctuate throughout the year. Thus, there are peaks and valleys in fund balances. These balances are invested in order to insure maximum interest return, while insuring the availability of funds to meet expenditures. Interest income earned during the year in this method totaled $6,415,750.

Budgets and Accounts

Budgeted revenues for the 1964–65 fiscal year amounted to $861,451,675, of which $300,822,514 remained to be collected on June 30, 1965. Revenue not received consists of $254,941,705 of federal aid and $45,880,809 contributions from state and local agencies and other sources, which will be collected as applicable work is completed. Expenditures and obligations incurred applicable to the fiscal year ended June 30, 1965, amounted to $854,769,639.

Federal and Local Government Relations Accounting

Cities and Counties Accounting

Amendments to the Collier-Unruh Local Development Transportation Act enabled the consolidation of reports to be submitted by cities and counties. This will save considerable effort and administrative cost in the cities, counties, and the Division of Highways.

Federal Aid Vouchering Section

During the year the backlog of unbilled federal aid was reduced by $14,000,000. Assuming an average additional balance in the State Highway Fund of half of this amount invested at the current rate of return, which is close to 4 percent, this reduction in backlog produced added income for the State Highway Fund of approximately $280,000.

1966-67 Highway Budget

The California Highway Commission budgeted $651,919,655 for state highway construction purposes, including rights-of-way and engineering, for the 1966–67 fiscal year.

This figure, up $39,487,655 from the 1965–66 highway budget adopted a year ago, contains $450,621,000 for major construction and improvement (including engineering); $179,848,655 for rights-of-way; plus other amounts for contingencies, resurfacing programs, signs and striping, highway planning studies and minor improvements.

A total of $3,000,000 has again been earmarked in the new budget for traffic safety and operational improvement projects in the $5,000–$50,000 bracket, particularly at points of accident concentration. These range from easing curves, installing or modifying signals, constructing left-turn storage lanes, applying antiskid treatment to the road surface, providing truck climbing lanes, and many more.

State Highway Engineer J. C. Womack had told the commission that more costly and extensive projects for accident reduction, such as replacing narrow bridges, installing median barriers on freeways, and improving highway alignment through rugged terrain, as well as the most important measure of all for accident reduction, the replacing of conventional highways with access-controlled freeways, will be financed out of general construction funds.

In submitting the budget to Governor Edmund G. Brown, Robert B. Bradford, chairman of the commission and Administrator of the Transportation Agency, pointed out that the newly adopted budget will provide for about 320 miles of new multilane freeways and adding lanes on another 29 miles of existing freeways.

"Thanks to wise and timely legislation which added an extra 1-cent-per-gallon tax on gasoline between April 1st and August 31st to repair the highways ravaged by last winter's floods," Bradford said, "all of the moneys for state highway construction in the new budget will continue progress on our master-planned freeway and expressway system, as well as to improve traffic safety and mobility in all areas of the state."

He emphasized that the major construction effort in the new budget continues on California's 2,166-mile share of the national system of interstate and defense highways. The budget contains $339,409,355 in federal funds, of which $289,205,850 is included for the completion of this system, which by federal law, must be accomplished by 1972.

In line with increased emphasis on aesthetics and highway beautification, the commission chairman added that funds for landscaping, and functional and tree planting along various freeway routes have been increased from $6,229,000 in last year's budget to $9,259,000.

"This great increase was made possible by the Legislature's raising its statutory limitation on funds for landscape maintenance at its last session," he added. "Our landscaped freeways frequently provide much needed green belts in the urban areas they traverse, but they are expensive to maintain."

"Our travel today is approximately 90 billion vehicle-miles per year," Bradford said. "By 1980, Californians will drive a staggering 200 billion such miles. We must budget every penny of available funds to guard against future traffic congestion choking our economy and way of life."

The commission approved some projects which are only partly financed in the 1966-67 budget, but which under current federal and state procedures can be placed under contract in their entirety with the assurance that the balance will be included in the next fiscal year budget.

It also allocated $59,774,000 to finance the balance of projects approved in the 1965-66 budget.

In addition to the construction items, the commission budgeted $87,160,000 for state highway purposes other than construction, including $50,900,000 for maintenance; $17,400,000 for administration; $7,460,000 for maintenance of landscaping, functional planting and safety roadside rests; $5,000,000 for buildings and land; $2,200,000 for highway research; $1,150,000 for honor camps; and $50,000 for legislative claims.

A third budget segment totalling $157,036,025 was allocated for functions not under state highway jurisdiction.

The largest non-state-highway items are $76,750,000 for construction and rights-of-way for streets and roads on the select system of cities and counties as established by the 1963 Legislature, and $53,483,000 for improvements and maintenance work on city streets.

The other such items are $8,513,325 in federal aid for county roads on the federal aid secondary system, and $4,200,000 in state funds to counties for use in matching these federal funds; $5,000,000 in state funds to help finance railroad grade separation projects on local streets and roads; $3,797,700 in state funds to pay part of the cost of extending federal aid secondary county roads into urban areas; $3,400,000 for maintenance of state-owned toll bridges; $1,500,000 in engineering funds for cities; and $142,000 for administration of the Outdoor Advertising Act.

The total estimated revenue from all state sources is $548,193,000, a gain of $33,202,242 over such revenue for the present fiscal year. It will derive from $397,498,000 in gasoline taxes; $99,753,000 in motor vehicle fees, $31,100,000 in taxes on diesel fuel, $15,700,000 in taxes on for-hire vehicles, $4,000,000 in interest, and $142,000 in outdoor advertising fees.

1966-67 State Highway Budget by Region, Counties

NOTE 1—The term "freeway" means a multilane divided highway with full access control, no crossings at grade, no stop lights and no left-turn movements. An "expressway" has the same access control as the freeway but does permit left turns and crossings at grade at some intersections which may or many not be signalized. "Two-lane expressways" are two-lane highways with access control, and are usually planned for future expansion to four lanes.

NOTE 2—Projects which overlap county lines are listed in both counties.

NOTE 3—Construction contracts financed in this new budget may be awarded beginning January 1966; right-of-way funds may not be spent until July 1, 1966, the start of the fiscal year.

NOTE 4—Questions concerning individual items can best be answered by your Division of Highways district office. This includes questions about route numbers, which, as you probably recall, were extensively revised two years ago.

NORTH COASTAL COUNTIES PROJECTS

Del Norte County

Add truck climbing lanes on the uphill sections of US 101 through Del Norte Coast Redwood State Park south of Crescent City. Estimated cost, $680,000.

Rights-of-way on various state highway routes—$91,500.

Humboldt County

Extend the recently completed four-lane US 101 Freeway construction between Sylvandale and Dean Creek another 4.3 miles southerly to 0.8 mile south of Garberville. The project involves constructing interchanges at the existing highway near Dean Creek, one just north of Garberville, and with Sprowel Creek Road. Estimated cost, $6,250,000.

Grade portions of the future two-lane Route 299 Expressway between 10.4 and 11.6 miles east of Blue Lake, and install culverts. Estimated cost, $300,000.

Improve curves on portions of Route 36 between 1.3 and 10.0 miles east of Bridgeville. Estimated cost, $100,000.

Rights-of-way on various state highway routes—$545,450.

Lake County

Widen the northern half of the intersection of Routes 29 and 53 at Lower Lake, and a 0.2 mile section of Route 53 north of the intersection to provide channelization. The project involves installing highway lighting at the intersection and constructing a service road from Route 29 to a subdivision southwest of the intersection. Estimated cost, $100,000.

Resurface Route 29 between 0.9 mile south of Kelseyville and Route 175, a distance of 6.8 miles, prior to relinquishing this highway section to the county upon completion of a paralleling freeway, now under construction. Estimated cost, $95,000.

Rights-of-way on various state highway routes—$520,000.

Mendocino County

Construct US 101 as a four-lane freeway between 1.2 miles south of Cummings Post Office and Cedar Creek, a distance of 5.2 miles, with an interchange to serve the community at Cummings. The project involves constructing the highest highway embankment in California, and probably the world, at Squaw Creek. It will be 372 feet high and 900 feet long. Another huge embankment at Grizzly Creek will be 247 feet high and 800 feet long. The project also involves constructing four sidehill viaducts totaling one-half mile in length to carry the traffic lanes because of the rugged nature on the terrain. Estimated cost, $15,500,000, of which $9,700,000 will be budgeted in the 1967–68 fiscal year.

Extend the two-lane Route 20 Expressway east of US 101 near Calpella another 5.1 miles easterly to 0.6 mile east of North Fork Cold Creek. Estimated cost, $2,100,000.

Construct Route 20 on new alignment between US 101 and 0.6 mile westerly. Estimated cost, $210,000.

Rights-of-way on various state highway routes—$340,000.

SACRAMENTO VALLEY AND NORTHERN VALLEY PROJECTS

Butte County

Relocate Route 32 from First and Main Streets to Oroville Avenue and Eighth and Ninth Streets in Chico to permit the expansion of Chico State College. Estimated cost, $360,000. The city will contribute the cost of improving drainage.

Rights-of-way on various state highway routes—None.

Colusa County

Extend a completed four-lane Interstate 5 Freeway section in Arbuckle 5.5 miles southerly and approximately 8.0 miles northerly to Husted Road south of Williams, where the future freeway will depart from the alignment of the existing highway. The project involves revising the Hillgate Road Interchange and constructing an interchange north of Arbuckle. Estimated cost, $7,500,000, of which $3,100,000 will be budgeted in the 1967–68 fiscal year.

Rights-of-way on various state highway routes—$410,000.

El Dorado County

Extend a four-lane US 50 Freeway section 7.5 miles westerly to a connection with an existing two-lane expressway section, 0.8 mile west of Shingle Springs. The project involves constructing interchanges at Missouri Flat, Greenstone and Pondorosa Roads. Estimated cost, $7,700,000, of which $4,700,000 will be budgeted in the 1967–68 fiscal year.

Rights-of-way on various state highway routes—$250,000.

Glenn County

Rights-of-way on various state highway routes—$150,000.

Lassen County

Replace substandard timber bridges across Meadow Channel and Willow Creek on Route 139, approximately 17 miles north of Susanville, with wider concrete structures. Estimated cost, $60,000.

Rights-of-way on various state highway routes—$111,000.

Modoc County

Grade a portion of Route 139 on new alignment between Route 299 near Canby and 8.2 miles northerly, and pave the northerly 2.2 miles as the first stage of two-lane expressway construction. Estimated cost, $1,430,000.

Rights-of-way on various state highway routes—$39,000.

Nevada County

Construct portions of Route 49 on improved alignment between 1.5 miles north of the South Fork Yuba River and North San Juan. Estimated cost, $100,000.

Rights-of-way on various state highway routes—None.

Placer County

Construct paired safety roadside rests on the Interstate 80 Freeway at Gold Run and install water, comfort facilities and picnic tables. Estimated cost, $229,000.

Landscape the Douglas Boulevard Interchange on the Interstate 80 Freeway in Roseville. Estimated cost, $170,000.

Rights-of-way on various state highway routes—$705,000.

Plumas County

Construct a two-lane expressway on Route 36 between Chester and 6.9 miles easterly. The project involves constructing a safety roadside rest at the top of Johnson Grade, overlooking Lake Almanor. Estimated cost, $1,000,000.

Rights-of-way on various state highway routes—$211,000.

Sacramento County

Construct the eight-lane Interstate 5 Freeway between J Street in Sacramento and the future Interstate 880 Freeway near San Juan Road, and extend this route as a six-lane freeway from this point to Route 99 at Bayou Way, a total distance of approximately seven miles. This freeway section will connect with inital two-lane expressway construction in progress on Interstate 5 westerly to Elkhorn. The project involves constructing a northbound on-ramp from L Street in Sacramento to this freeway, an interchange at J-I Streets to serve the I Street Bridge and the Old Sacramento Historic Project area, an interchange at Richards Boulevard, paired freeway bridges across the American River, plus interchanges at Garden Highway, West El Camino Avenue extended, Interstate 880, Del Paso Road and Route 99. Estimated cost, $27,636,000, of which $9,224,000 will be budgeted in the 1967–68 fiscal year. A total of $3,000,000 was budgeted in the 1965–66 fiscal year for the construction of the bridges across the American River and the interchange at Richards Boulevard.

$8,360,000 to complete the financing of the Interstate 80 (W-X Street) Freeway in Sacramento between Fifth Street and Alhambra Boulevard, a distance of 1.8 miles. Estimated cost, $17,560,000, of which $9,200,000 was budgeted in the 1965–66 fiscal year. This project will complete freeway construction on Interstate 80 from Jefferson Boulevard in Yolo County through the City of Sacramento.

$1,050,000 to complete the construction of the interchange between the Interstate 80 and US 50 Freeways at the intersection of W-X and 29th and 30th Streets in Sacramento, with connections to 34th Street.

Landscape the Interstate 80 Freeway between P and E Streets in Sacramento, a distance of 0.9 mile. Estimated cost, $110,000.

Rights-of-way on various state highway routes—$13,355,000.

Shasta County

Extend freeway construction in progress on Interstate 5 (between Anderson and two miles north of Redding) another 16.1 miles northerly to three miles north of O'Brien, connecting to freeway construction in progress to the Sacramento River Bridge at Antler. The first 3.5 miles to Shasta Dam Boulevard (Route 151) will have six lanes and the remainder four. North of the Pit River Bridge, work will consist of constructing two lanes to carry northbound traffic and reconstructing and widening the existing two-lane highway for southbound traffic. The project involves constructing interchanges at Oasis Road, Pine Grove, Shasta Dam Boulevard (Route 151), Mountain Gate, Fawndale Road, Bridge Bay, Turntable Bay and O'Brien, and safety roadside rests one mile north of the Pit River Bridge and 1.5 miles south of O'Brien, overlooking Shasta Lake. It also involves constructing truck climbing lanes on steep uphill grades. Widening of the Pit River Bridge is in progress under previous financing. Estimated cost, $14,330,000, of which $5,830,000 will be budgeted in the 1967–68 fiscal year.

$1,550,000 to complete the financing of the four-lane Interstate Freeway between 1.9 miles north of O'Brien and the south end of the Sacramento Bridge at Antler, a distance of 4.6 miles. The project involves constructing an interchange with county roads at Salt Creek. Estimated cost, $4,650,000, of which $3,100,000 was budgeted in the 1965–66 fiscal year.

Widen the Sacramento River Bridge at Antler on Interstate 5 to provide a median divider between opposing traffic lanes. Estimated cost, $300,000.

Construct channelization on Route 299 at Old Oregon Trail Road, approximately 2.5 miles east of Interstate 5 at Redding. Estimated cost, $100,000.

Landscape the Route 299 Freeway between Liberty Street in Redding and the Interstate 5 Freeway, a distance of 1.5 miles. Estimated cost, $66,000.

Widen Placer Street (Federal Aid Secondary Route 1393) to two lanes of an eventual four-lane highway between Wisconsin Avenue and San Francisco Street in Redding as an urban extension project, a distance of 0.9 mile. Estimated cost, $151,000 of which the state will pay $75,500 and Redding the balance.

Rights-of-way on various state highway routes—$554,000.

Sierra County

Reconstruct Route 49 between 1.3 and 5.2 miles east of Sierraville. Estimated cost, $180,000.

Widen portions of Route 49 and improve drainage between Yuba Pass and 1.6 miles west of Route 89. Estimated cost, $100,000.

Rights-of-way on various state highway routes—None.

Siskiyou County

Construct the four-lane Interstate 5 Freeway between 11.1 miles north of Yreka and Bradley-Henley Road, a distance of 3.3 miles. The project involves constructing paralleling freeway bridges across the Klamath River, and a third bridge to connect the existing highway, north of the river, with a future safety roadside rest which will be constructed on the river's south bank. Estimated cost, $6,300,000, of which $3,300,000 will be budgeted in the 1967–68 fiscal year.

Construct two bridges to carry the future Interstate 5 Freeway traffic across the Southern Pacific Company's railroad tracks near the Weed Airport and at Granada. Estimated cost, $885,000.

Rights-of-way on various state highway routes—$1,483,050.

Sutter County

Replace a mile-long timber bridge on Route 113 across the Sutter Bypass north of Knights Landing with a wider concrete structure, and construct about one mile of approaches. Estimated cost, $1,810,000.

Rights-of-way on various state highway routes—$450,000.

Tehama County

Replace a substandard timber bridge on Route 36 across the North Fork Deer Creek, approximately one mile west of Route 32 west of Chester, with a wider, steel structure on new alignment, and construct 0.9 mile of two-lane expressway approaches. Estimated cost, $480,000.

Lengthen the Burch Creek Bridge on Route 5, approximately 0.4 mile south of Corning, prior to the relinquishment of this highway section to the county upon completion of the Interstate 5 Freeway, now under construction. Estimated cost, $80,000.

Rights-of-way on various state highway routes—$61,500.

Trinity County

Grade a portion of the county route between Weaverville and Etna via Scotts Mountain (Federal Aid Secondary Road 189) on new alignment from Coffee Creek to 5.8 miles northerly, and pave the first 2.8 miles, as the first stage of two-lane expressway construction. This entire route will eventually be constructed to expressway standards as Route 3 in the state system of scenic highways. Estimated cost, $1,650,000.

$130,000 to complete the financing for widening and surfacing Bramlot and Cold Creek Roads, newly acquired in the state highway system to carry Route 36 on improved alignment, between Dubakella Mountain Road and 4.5 mile west of the Shasta county line, a distance of 9.6 miles. The 1964-65 fiscal year budget contained $200,000 for this project.

Rights-of-way on various state highway routes—$77,000.

Yolo County

Rights-of-way on various state highway routes—$1,450,000.

Yuba County

Construct the initial two lanes of an eventual four-lane freeway on Route 70 between Bear River and just south of McGowan Road, south of Marysville, and construct a four-lane freeway from this point to Route 65, a total distance of 8.4 miles, with interchanges at McGowan Road and Route 65. The project involves constructing almost one mile of Route 65 south of the completed freeway to Marysville as a four-lane divided highway. Estimated cost, $3,300,000 of which $800,000 will be budgeted in the 1967-68 fiscal year.

Rights-of-way on various state highway routes—None.

SAN FRANCISCO BAY REGION PROJECTS

Alameda County

Construct the eight-lane Route 24 (Grove-Shafter) Freeway in Oakland between south of 27th Street and north of 51st Street, a distance of 1.8 miles. The project involves constructing interchanges at 27th Street, Interstate 580, Grove Street and 52nd Street, and provision in the median for trains of the Bay Area Rapid Transit District. Estimated cost, $19,540,000, of which $9,740,000 will be budgeted in the 1967–68 fiscal year. The BARTD will contribute $1,925,000 as its share of the project.

Extend the eight-lane Interstate 580 Freeway from construction in progress (at the interchange of Interstate Routes 580 and 205, west of San Joaquin county line) through Altamont Pass to 0.5 mile east of Vasco Road near Livermore, a distance of 8.5 miles. Approximately half this distance will have wide separation between eastbound and westbound traffic lanes. The project involves constructing interchanges at Grant Line Road, North Flynn Road and Greenville Road, and the reconstructing of the Agricultural Inspection Station at Laughlin Road. It also involves constructing a roadside rest at the Grant Line Road Interchange, and truck stop facilities at the North Flynn Road Interchange. Estimated cost, $14,500,000, of which $9,500,000 will be budgeted in the 1967–68 fiscal year.

Landscape the Interstate 580-Warren Boulevard (Route 13) Freeway Interchange at Mills College in Oakland, plus the stretch of Interstate 580 between 108th and Birdsall Avenues, a distance of 4.4 miles, and along the Warren Boulevard Freeway between Interstate 580 and Redwood Road, a distance of 1.3 miles. Estimated cost, $771,000.

Landscape the Interstate 580 Freeway between 0.2 mile west of 173rd Avenue and 0.4 mile west of Gabriel Court, in and near San Leandro, a distance of 2.9 miles. Estimated cost, $300,000.

$4,245,000 to complete the financing of a budgeted project to extend the Interstate 680 Freeway 8.7 miles northerly from Route 84 near Scotts Corner to construction in progress between south of Interstate 580 and one mile north of the Alameda-Contra Costa county line. The project involves constructing interchanges at Route 84, Sunol Road, Pleasanton-Sunol Road, Vernal Avenue, and twin bridges across the Arroyo de la Laguna. This project, together with a project under construction between 0.9 mile north of the Alameda-Contra Costa county line and Danville, will complete the Interstate 680 Freeway from Fremont in Alameda County to Vallejo in Solano County. Estimated cost, $8,360,000 of which $4,115,000 had been budgeted in the 1965–66 fiscal year.

Landscape the Interstate 680 Freeway between 0.4 mile south of Interstate 580 in Alameda County and 1 mile north of the Alameda-Contra Costa county line, a distance of 3.2 miles. Estimated cost, $380,000. (Also listed in Contra Costa County.)

Construct an interchange on the Nimitz Freeway (Route 17) at 66th Avenue in Oakland, and add one lane for northbound traffic between 0.4 mile north of Hegenberger Road and High Street, to serve the future sports arena to be built at this location. The city will provide the necessary rights-of-way. Estimated cost, $1,800,000.

Widen the Winton Avenue Overcrossing on the Nimitz Freeway (Route 17) in Hayward from two to four lanes, and construct additional ramps to provide a complete four-leaf-clover interchange. Estimated cost, $720,000.

Widen the Nimitz Freeway (Route 17) from four to six lanes between 0.5 mile south of Tennyson Road and 0.1 mile north of Jackson Street (Route 92) in Hayward, a distance of 1.7 miles, and construct a median barrier in this section, extending southerly to 0.4 mile south of Jarvis Avenue in Fremont. Estimated cost, $590,000.

Add ramps to the Dixon Road Overcrossing of the Nimitz Freeway (Route 17) in Milpitas, Santa Clara County, and Fremont, Alameda County, to convert it to a full interchange. Estimated cost, $205,000. (Also listed in Santa Clara County.)

Add auxiliary lanes to the northbound Interstate 80 Freeway between the distribution structure east of the San Francisco-Oakland Bay Bridge in Oakland and Ashby Avenue, 1.4 miles northerly. Estimated cost, $765,000.

Widen Route 238 (Mission Boulevard) to four lanes divided and install channelization, curbs, gutters and parking lanes between Highland Blvd. and Jackson Street (Route 92) in Hayward, a distance of 0.4 mile. Estimated cost, $165,000.

Construct shoulders on Route 84 between Interstate 680 near Scotts Corner and Livermore, a distance of 7.2 miles. Estimated cost, $100,000.

Rights-of-way on various state highway routes—$6,529,000.

Contra Costa County

Landscape the Interstate 680 Freeway between 0.4 mile south of Interstate 580 in Alameda County and 1 mile north of the Alameda-Contra Costa county line, a distance of 3.2 miles. Estimated cost, $380,000. (Also listed in Alameda County.)

Resurface portions of Route 680 and improve drainage between one mile north of the Alameda county line and 1.6 miles south of Sycamore Valley Road in Danville. This highway section will be relinquished to the county upon completion of freeway construction on this route. Estimated cost, $58,000.

Widen Taylor Boulevard (Federal Aid Secondary Route 1326) to four lanes divided as an urban extension project between Morello Avenue and Ruth Drive in Pleasant Hill. Estimated cost, $136,800, of which the state will pay $59,400 and Pleasant Hill the balance.

Rights-of-way on various state highway routes—$2,150,000.

Marin County

Resurface portions of US 101 between the Richardson Bay Bridge and Corte Madera Creek. Estimated cost, $275,000.

Resurface portions of US 101 between 0.7 mile north of Atherton Avenue in Novato, Marin County, and 0.9 mile south of the Northwestern Pacific Company's railroad overhead south of Petaluma, Sonoma County. Estimated cost, $175,000. (Also listed in Sonoma County.)

Rights-of-way on various state highway routes—$720,000.

Napa County

Landscape the Route 29 Freeway between Old Sonoma Road and Napa Creek in Napa, a distance of 1 mile, including the First Street Interchange. Estimated cost, $105,000.

Widen about 0.4 mile of Route 128 on slightly improved alignment in Sage Creek Canyon, 10 miles east of Rutherford. Estimated cost, $100,000.

Add 0.5 mile of passing lanes to Route 29 north of the summit of Mount St. Helena. Estimated cost, $87,000.

Rights-of-way on various state highway routes—$20,000.

San Francisco County

$2,800,000 to complete the financing for extending the six-lane Route 82 Freeway northeasterly to the site of the Islais Creek Interchange with the future freeway via Hunters Point, thence northerly as the eight-lane Route 87 Freeway to 0.1 mile north of 18th Street, a distance of 1.4 miles. Estimated cost, $9,500,000, of which $6,700,000 had been budgeted in the 1965–66 fiscal year.

Widen the James Lick Memorial Freeway (US 101) to eight lanes in the Army Street area of San Francisco, and add a southbound auxiliary lane between the Army Street on-ramp and the Route 82 (Southern) Freeway. Estimated cost, $1,600,000.

Landscape the Interstate 280 Freeway between Eastmoor Avenue in Daly City, San Mateo County, and the San Francisco county line, and the Route 1 (Southern) Freeway between its junction with Interstate 680 in Daly City and San Jose Avenue in San Francisco, a total distance of 2.7 miles. Estimated cost, $500,000. (Also listed in San Mateo County.)

Rights-of-way on various state highway routes—$155,000.

San Mateo County

Construct 5.7 miles of the eight-lane Interstate 280 Freeway connecting the freeway bridge across San Mateo Creek, now under construction, with construction in progress between Larkspur Drive in Millbrae and San Bruno Avenue in San Bruno. The project involves constructing a temporary connection between the bridge and Skyline Boulevard (Route 35) at Bunker Hill Drive,

and interchanges at Hayne Road, Trousdale Drive, Millbrae Avenue-Hillcrest Boulevard, and Larkspur Drive, and a safety roadside rest for northbound traffic just north of the bridge. Estimated cost, $8,800,000, of which $3,900,000 will be budgeted in 1967–68 fiscal year.

Construct 2.5 miles of the eight-lane Interstate 280 Freeway between 0.1 mile south of Woodside Road (Route 114) and 0.1 mile north of Raymundo Drive at Canada Road in Woodside. The project involves constructing an interchange at Woodside Road and another at Farm Hill Boulevard to serve the future South County Campus of the College of San Mateo. Estimated cost, $5,380,000, of which $1,000,000 will be budgeted in the 1967–68 fiscal year.

$1,805,000 to complete the financing for constructing the eight-lane Interstate 280 Freeway between Eastmoor Avenue in Daly City and 0.5 mile south of Arroyo Drive west of South San Francisco, a distance of 3.3 miles, with interchanges at Westborough Boulevard, the future Hickey Boulevard Extension at Collins Avenue, and the future Route 1 Freeway. Estimated cost, $10,430,000, of which $8,625,000 had been budgeted in the 1965–66 fiscal year.

$896,000 to complete the financing of rough grading portions of the eight-lane Interstate 280 Freeway between Summit Drive in Hillsborough and Larkspur Drive in Millbrae, and constructing an eight-lane freeway on this route between Larkspur Drive and 0.3 mile south of future Route 186 near San Bruno Avenue in San Bruno, with interchanges at Skyline Boulevard (Route 35) and Junipero Serra Boulevard, a distance of 2.2 miles. Estimated cost, $6,896,000, of which $6,000,000 had been budgeted in the 1965–66 fiscal year.

Landscape the Interstate 280 Freeway between Eastmoor Avenue in Daly City, San Mateo County, and the San Francisco county line, and the Route 1 (Southern) Freeway between its junction with Interstate 280 in Daly City and San Jose Avenue in San Francisco, a total distance of 2.7 miles. Estimated cost, $500,000.

Extend the four-lane Route 92 (19th Avenue) Freeway 2.3 miles westerly to the site of an interchange with the future Interstate 280 Freeway at Ralston Avenue west of Belmont, with interchanges at West Hillsdale Boulevard, Monterey Street Extended, and Ralston Avenue-Polhemus Road, and construct 2.1 miles of this freeway on Brewer Island between east of Marina Lagoon and the San Mateo-Hayward Bridge, with an interchange at Foster City Boulevard. Route 92 traffic will use 19th Avenue between the eastern end of the existing freeway at Grant Street and South Norfolk Street pending future freeway construction. The project involves construction of a temporary connection to South Norfolk Street in San Mateo, including a bridge that will serve a future frontage road across Marina Lagoon. Also involved is the addition of ramps on the nearby Bayshore (US 101) Freeway at East Hillsdale Boulevard in San Mateo to provide a full four-leaf-clover interchange. Estimated cost, $6,590,000, of which the state will pay $6,500,000 ($2,000,000 in the 1967–68 fiscal year) and the county the balance.

Resurface and construct shoulders on Skyline Boulevard (Route 35) between 0.3 mile north of Crystal Springs Road in San Bruno and Route 1 in Daly City, a distance of 5.2 miles. Estimated cost, $300,000.

Landscape portions of the Route 1 Freeway between 0.5 mile south of Sharp Park Road and 0.4 mile north of Manor Drive in Pacifica. Estimated cost, $250,000.

Resurface La Honda Road (Route 84) between La Honda and 6.2 miles westerly. Estimated cost, $175,000.

Rights-of-way on various state highway routes—$4,350,000.

Santa Clara County

$1,782,000 to complete the financing for extending the six-lane Interstate 280 Freeway 1.9 miles westerly from Stelling Road in Cupertino to 0.6 mile west of Foothill Boulevard (Mountain View-Stevens Creek Road) with interchanges at Route 85 and Foothill Boulevard, and twin bridges across Stevens Creek. Estimated cost, $4,233,000, of which $2,317,000 had been budgeted in the 1965–66 fiscal year. Santa Clara County has contributed $134,000 toward the project.

Add ramps to the Dixon Road Overcrossing of the Nimitz Freeway (Route 17 in Milpitas, Santa Clara County, and Fremont, Alameda County, to convert it to a full interchange. Estimated cost, $205,000. (Also listed in Alameda County.)

Add a southbound lane in the median of the Route 17 Freeway between Hamilton Avenue in Campbell and Interstate 280 in San Jose, a distance of 1.8 miles. Estimated cost, $126,000.

Construct a pedestrian overcrossing of the Route 17 Freeway between Westfield Drive in San Jose and Downing Avenue in Campbell. Estimated cost, $64,000, of which the state and San Jose will share equally.

Landscape the Route 85 (Stevens Creek) Freeway between Homestead Road in Cupertino and the Bayshore (US 101) Freeway, and the Route 237 Freeway between El Camino Real (Route 82) in Mountain View and 0.2 mile north of the Southern Pacific Company's railroad tracks, a total distance of 6.4 miles. Estimated cost, $550,000.

Complete the landscaping of the interchange between the Bayshore (US 101) Freeway and the Oregon Expressway-Embarcadero Road in Palo Alto. Estimated cost, $98,000.

Tree and functional planting on the Bayshore (US 101) Freeway between south of Mathilda Avenue in Sunnyvale and Matadero Creek in Palo Alto, a distance of six miles. Estimated cost, $54,000.

Resurface portions of the US 101 Freeway between San Antonio Street and Silver Creek in San Jose. Estimated cost, $50,000.

Construct the San Tomas Expressway (Federal Aid Secondary Route 1010) as a four-lane divided highway on new alignment as an urban extension project between the Bayshore Freeway (US 101) and Forbes Avenue near San Jose. Estimated cost, $6,180,000, of which the state will pay $625,000 and the City and County of Santa Clara the balance.

Construct the San Tomas Expressway (Federal Aid Secondary Route 1010) as a four-lane divided highway on new alignment as an urban extension project between Budd Avenue and Camden Avenue at the Los Gatos Freeway near San Jose, a distance of 0.6 mile. Estimated cost, $1,390,000, of which the state will pay $695,000 and Campbell and Santa Clara County the balance.

Widen Homestead Road (Federal Aid Secondary Route 1004) to the initial four lanes of an ultimate four-lane divided highway as an urban extension project between the Lawrence Expressway and Kennewick Drive near Cupertino, a distance of 2.7 miles. Estimated cost, $860,000, of which the state will pay $430,000 and Cupertino, Sunnyvale, Santa Clara and Santa Clara County the balance.

Rights-of-way on various state highway routes—$22,877,000.

Santa Cruz County

Construct an interchange and frontage roads on the four-lane Route 1 Expressway at Rio del Mar Boulevard in the Aptos area. Estimated cost, $700,000.

Widen and add shoulders to Route 152 between the northeast city limit of Watsonville and Casserly Road, 2.4 miles northeasterly. Estimated cost, $305,000, of which the state will pay $235,000, and the county the balance.

Extend Green Valley Road (Federal Aid Secondary Route 1270) as a two-lane facility of an ultimate four-lane divided highway, an urban extension project, between existing Route 1 and the new Route 1 Freeway in Watsonville, a distance of 0.3 mile. Estimated cost, $70,000, of which the state will pay $35,000 and Watsonville the balance.

Rights-of-way on various state highway routes—$50,000.

Sonoma County

Construct interchanges on US 101 at College Avenue and at 3rd-4th-5th Street, and an undercrossing at 9th Street, in Santa Rosa to complete the conversion of this route from expressway to full freeway standards between north of Healdsburg and south of Petaluma. Estimated cost, $3,809,000.

Landscape the US 101 Freeway between Edwards Avenue and the Mendocino Avenue Overcrossing in Santa Rosa, a distance of 1.4 miles. The project involves landscaping the Steele Lane Interchange. Estimated cost, $95,000.

Install underdrains at various locations on Route 1 (Shoreline Highway) between Fort Ross and Stewarts Point. Estimated cost, $100,000.

Rights-of-way on various state highway routes—$10,000.

CENTRAL COASTAL COUNTIES PROJECTS

Monterey County

Construct a four-lane freeway on Route 1 between Viejo Road at the south city limit of Monterey and Fort Ord, a distance of 6.7 miles, with interchanges at Munras Avenue, Aguajito Road, Route 68, Casa Verde Avenue, Del Monte Avenue, Humboldt Street and Fremont Street. Estimated cost, $10,000,000, of which $2,600,000 will be budgeted in the 1967–68 fiscal year.

Construct a four-lane freeway on US 101 between one mile south of King City and one mile north of the Salinas River, a distance of 3.1 miles, as a bypass of King City. The project involves constructing interchanges at First Street, Canal Street, Broadway and Jolon Road, and replacing a narrow steel bridge carrying southbound traffic across the Salinas River with a wider concrete structure. Estimated cost, $4,200,000, of which $1,700,000 will be budgeted in the 1967–68 fiscal year.

Tree and functional planting along the US 101 Freeway between Sherwood Drive Overcrossing in Salinas and 0.5 mile south of Espinosa Road, a distance of 3.3 miles. Estimated cost, $105,000.

Rights-of-way on various state highway routes—$2,280,000.

San Benito County

Extend the initial two lanes of an ultimate four-lane expressway on Route 156 from 2.3 miles north of Hollister another 5.1 miles northerly to the Santa Clara county line. The project involves constructing bridges across Tequesquito Slough and Pacheco Creek. Estimated cost, $1,250,000.

Reconstruct and widen Route 25 on new alignment between 0.7 mile south of the San Benito River and 5 miles northerly, approximately 16 miles south of Hollister. Estimated cost, $915,000.

Replace a narrow timber bridge on Route 25 across Willow Creek, 22 miles south of Hollister, with a wider, concrete structure on improved alignment and construct approaches. Estimated cost, $80,000.

Rights-of-way on various state highway routes—$205,000.

San Luis Obispo County

Extend the initial two lanes of the ultimate four-lane Route 1 (Cambria Bypass) Expressway 5.9 miles northerly between 0.6 mile south of San Simeon Creek and 0.5 mile north of San Simeon. The project involves widening a bridge across San Simeon Creek. Estimated cost, $1,500,000.

Reconstruct the base and pavement of ramps to and from US 101 in the City of San Luis Obispo north of the Marsh Street Interchange. Estimated cost, $160,000.

Tree and functional planting on portions of US 101 between 0.4 mile south of the US 101-Route 1 Interchange in Pismo Beach and 0.1 mile north of Marsh Street in San Luis Obispo. Estimated cost, $115,000.

Replace a narrow steel truss bridge on Route 227 across the East Fork Pismo Creek, north of Arroyo Grande with a wider, concrete structure. Estimated cost, $90,000.

Rights-of-way on various state highway routes—$480,000.

Santa Barbara County

Revise an interchange at Santa Monica Road west of Carpinteria and construct interchanges at the east and west ends of Padaro Lane and at Evans Avenue near Summerland to convert five miles of US 101 from expressway to full freeway standards. Estimated cost, $2,900,000.

Construct an interchange on US 101 at Clark Avenue, six miles south of Santa Maria, as part of a continuing program to convert this route to full freeway standards. Estimated cost, $700,000.

Widen Fairview Avenue in Goleta across the US 101 Freeway and the Southern Pacific Company's railroad tracks from two to four lanes. Estimated cost, $460,000.

Tree and functional planting along the US 101 Freeway between 0.7 mile south of the Santa Ynez River and 0.7 mile north of Buellton, a distance of 1.8 miles. Estimated cost, $120,000.

Construct the initial two lanes of the ultimate four-lane Route 246 Expressway between 0.6 mile west of Santa Rosa Creek and 3.5 miles west of Buellton, a distance of 2.8 miles. Estimated cost, $1,120,000.

Widen Route 1 from two to four lanes between Pine Avenue in Lompoc and 0.7 mile north of the Santa Ynez River, a distance of 2.1 miles. The project includes constructing a two-lane bridge for southbound traffic across the Santa Ynez River. Estimated cost, $1,000,000.

Landscape the Route 217 (Ward Memorial) Freeway between 0.5 mile north of the University of California Campus at Santa Barbara and US 101, five miles north of the City of Santa Barbara, a distance of 2.5 miles. Estimated cost, $170,000.

Rights-of-way on various state highway routes—$845,000.

Ventura County

Construct the four-lane Route 23 Freeway between Hillcrest Drive in Thousand Oaks and Tierra Rejada Road, 6.7 miles northerly, with interchanges at Hillcrest Drive, Janss Road, Avenue de Las Arboles, Olson Road and Tierra Rejada Road. Estimated cost, $10,000,000, of which $8,000,000 will be budgeted in the 1967–68 fiscal year.

Construct an interchange on the Ventura Freeway (US 101) at Lynn Road west of Thousand Oaks. Estimated cost, $900,000.

Construct access roads from private properties to the Rice Road and Rose Road interchanges on the Ventura Freeway (US 101), which together with a beginning 2.8-mile freeway project near Montalvo, will complete the conversion of this route from expressway to full freeway standards between the Conejo Summit and the City of Ventura. Estimated cost, $50,000.

Landscape and install functional planting on the Route 126 (Santa Paula) Freeway between 0.1 mile west of Wells Road (Route 118) at Saticoy and 0.7 mile east of Santa Paula, a distance of 8.5 miles, and construct a landscape maintenance building on Harvard Street (existing Route 126) near 10th Street in Santa Paula. Estimated cost, $363,000.

Widen Vineyard Avenue (Route 232) from two to four lanes between Oxnard Boulevard (Route 1) and the Ventura Freeway (US 101) near Oxnard, a distance of 0.4 mile. Estimated cost, $200,000.

Rights-of-way on various state highway routes—$6,000,000.

SAN JOAQUIN VALLEY AND CENTRAL MOUNTAIN COUNTIES PROJECTS

Alpine County

Clear and grade portions to extend the two-lane Route 4 Expressway now under construction 2.6 miles easterly to 3.2 miles east of the Calaveras county line. Additional grading and paving will be financed by subsequent budgets. Estimated cost, $250,000.

Rights-of-way on various state highway routes—$20,000.

Amador County

Construct a two-lane expressway on Route 16 between 0.1 mile west and 3.8 miles east of the Sacramento-Amador county line. Estimated cost, $800,000. (Also listed in Sacramento County.)

Rights-of-way on various state highway routes—$137,000.

Calaveras County

Rights-of-way on various state highway routes—$10,000.

Fresno County

Extend the grading and structures project now underway on the Interstate 5 (Westside) Freeway, between the Merced county line and 20.7 miles southeasterly, another 45.5 miles to the Kings county line. The project involves constructing interchanges at Lassen Avenue, Jayne Avenue, Route 198, Fresno-Coalinga Road, Route 33 and Kamm Avenue. Estimated cost, $8,620,000, of which $2,240,000 will be financed in the 1967–68 fiscal year.

Reconstruct Route 33 on new alignment as a two- and four-lane conventional highway between Laguna Canal in Fresno County and 0.1 mile north of Dos Palos in Merced County, a distance of 5 miles. The

section within the city will be four-laned. Estimated cost, $923,000, of which the state will pay $908,000, and the city the balance. (Also listed in Merced County.)

Landscape the US 99 Freeway between Kern Street and 0.1 mile northwest of Thorne Avenue in Fresno, a distance of 1.4 miles. Estimated cost, $85,000.

Rights-of-way on various state highway routes—$3,032,000.

Inyo County

Extend the recently completed reconstruction of Route 168 on improved alignment another 6.9 miles westerly from 0.5 mile west of the Southern California Edison Company's Powerplant No. 3 west of Bishop to Camp Sabrina. Estimated cost, $2,000,000.

Widen, reconstruct and improve drainage on Route 190 in Death Valley between 3.9 and 6.1 miles east of Stovepipe Wells. Estimated cost, $100,000.

Rights-of-way on various state highway routes—$200,000.

Kern County

Construct the four-lane Interstate 5 (Westside) Freeway between 0.4 mile south of Lerdo Avenue, west of Shafter, and 0.4 mile north of Route 46, east of Lost Hills, a distance of 11.3 miles. The project involves constructing interchanges at Lerdo Avenue and Route 46, and a bridge across the Kern River Flood Canal. Estimated cost, $6,000,000.

Add one lane to the northbound roadway and reconstruct and widen the southbound roadway of US 99 between Cawelo and 1.4 miles south of Route 46, a distance of 7 miles, and construct interchanges at Kimberlina Road and Merced Avenue, to convert this route from four-lane expressway to six-lane freeway standards. Estimated cost, $3,380,000.

Construct interchanges on US 99 at Sandrini Road and Herring Road, north of Wheeler Ridge, to complete the conversion of this route from expressway to full freeway standards between Bakersfield and the Los Angeles county line. Estimated cost, $843,000.

Plant trees along the US 99 Freeway and Oleander bushes in the median as a headlight screen between Minkler Spur near the north edge of Bakersfield and Cawelo, a distance of 8.7 miles. Estimated cost, $57,000.

Pave the four-lane Antelope Valley (Route 14) Freeway between Avenue I and 0.4 mile north of the Kern county line, a distance of 8.4 miles. Grading and structures were financed in the 1965–66 fiscal year. Estimated cost, $4,400,000. (Also listed in Los Angeles County.)

Extend the four-lane Route 14 (Antelope Valley) Freeway 4.9 miles northerly between the Los Angeles-Kern county line and 1.9 miles north of Rosamond. The project involves constructing an interchange at Rosamond Avenue. Estimated cost, $2,280,000.

Grade for the future Route 178 Expressway between one-quarter mile west of Borel Powerhouse and 1.1 miles easterly. The project involves constructing a bridge across the Kern River. Estimated cost, $1,325,000.

Resurface Route 58 between 1.2 miles west of Tehachapi and 12 miles easterly to Cameron Road. Estimated cost, $300,000.

Rights-of-way on various state highway routes—$2,132,000.

Kings County

Rights-of-way on various state highway routes—$145,000.

Madera County

Construct two additional lanes for westbound traffic on Route 152 to convert this highway to four-lane freeway and expressway standards between 0.8 mile west of the Merced-Madera county line and 0.6 mile west of County Road 10 in Madera County, a distance of 7.3 miles. The project involves constructing an interchange with Route 59 at the county line. Estimated cost, $1,650,000. (Also listed in Merced County.)

Right-of-way on various state highway routes—$40,000.

Mariposa County

Construct a two-lane expressway on Route 49 between 0.7 mile west of Usona Road and 0.1 mile west of Allred Road, a distance of 5.2 miles, approximately 3.5 miles southeast of Mariposa. The project includes constructing a bridge across the West Fork Chowchilla River. Estimated cost, $1,685,000.

Construct 5.4 miles of Route 132 on new and improved alignment between 0.5 mile west of the Tuolumne-Mariposa county line and 4.1 miles west of Coulterville. Estimated cost, $1,180,000. (Also listed in Tuolumne County.)

Reconstruct 0.2 mile of Route 140 to ease a curve, approximately two miles northeast of Midpines. Estimated cost, $90,000.

Rights-of-way on various state highway routes—None.

Merced County

$1,992,000 to complete the financing for extending the four-lane Interstate 5 (Westside) Freeway construction, now nearing completion in Merced County between Route 152 west of Los Banos and 2.8 miles north of Route 33, southwest of Gustine, another 36.1 miles northerly through Stanislaus County to the San Joaquin county line. The project involves constructing interchanges at Sullivan, Stuhr, Fink-Ward, Del Puerto Canyon and Ingram Creek Roads, and bridges across the Delta-Mendota Canal, 10 creeks and the California Aqueduct. Roadside safety rests are being provided on each side of the freeway just south of the San Joaquin county line. A vista point is being constructed for southbound traffic approximately 1.5 miles south of Orestimba Creek, and for northbound traffic at Salado Creek in Stanislaus County. Estimated cost, $17,443,000, of which $15,240,000 had been budgeted in the 1965–66 fiscal year. The Department of Water Resources has contributed $211,000 of the overall cost. (Also listed in Stanislaus County.)

Construct two additional lanes for westbound traffic on Route 152 to convert this highway to four-lane freeway and expressway standards between 0.8 mile west of the Merced-Madera county line and 0.6 mile west of County Road 10 in Madera County, a distance of 7.3 miles. The project involves constructing an interchange with Route 59 at the county line. Estimated cost, $1,650,000. (Also listed in Madera County.)

Extend the four-lane Route 152 Expressway 2.6 miles easterly to near the west city limit of Los Banos, and widen an additional 1 mile within the city from two to four lanes. Estimated cost, $690,000.

Reconstruct Route 33 on new alignment as a two- and four-lane conventional highway between Laguna Canal in Fresno County and 0.1 mile north of Dos Palos in Merced County, a distance of five miles. The section within the city will be four-laned. Estimated cost, $923,000, of which the state will pay $908,000, and the city the balance. (Also listed in Fresno County.)

Rights-of-way on various state highway routes—$1,298,000.

Mono County

Rights-of-way on various state highway routes—$30,000.

San Joaquin County

Construct Interstate 5 as an eight-lane freeway between Stockton Channel in Stockton and Country Club Boulevard, 1.7 miles northerly, and as a six-lane freeway between this point and March Lane, 1.5 miles farther north. This project involves constructing a bridge to carry Weber Avenue across relocated Mormon Slough and the substructures of the future paired Interstate 5 Freeway bridges across Stockton Channel. It also involves constructing interchanges at Pershing Avenue, Mount Diablo Boulevard, Country Club Boulevard-Telegraph Avenue, and March Lane. The construction of paired bridges and approaches across Smith's Canal and the Calaveras River was financed in the 1965–66 fiscal year budget. Estimated cost, $12,290,000, of which $4,905,000 will be financed in the 1967–68 fiscal year.

Widen Route 132 from 28 to 40 feet by constructing shoulders between Welty Road in San Joaquin County and the west city limit of Modesto at Carpenter Road, Stanislaus County, a distance of 14.3 miles. Estimated cost, $700,000. (Also listed in Stanislaus County.)

Reconstruct portions of Charter Way (Route 4) in Stockton between Center and B Streets, a distance of 1.5 miles. Estimated cost, $150,000.

Rights-of-way on various state highway routes—$4,653,000.

Solano County

Reconstruct West Texas Street (Route 12) between Pennsylvania Avenue and Washington Street in Fairfield, a distance of 0.5 mile.

and replace the traffic signals at Union Avenue, Madison Street, Webster Street and Pennsylvania Avenue. Estimated cost, $170,000, of which the state will pay $140,000, and the city the balance.

Construct 1.8 miles of the four-lane Route 37 freeway approaches to the Napa River Bridge, with interchanges at Walnut Street on Mare Island and Wilson Street near the west city limit of Vallejo. Construction of the bridge was financed in previous fiscal years. Estimated cost, $1,312,000.

Install trees and functional planting on the Interstate 80 Freeway between 3.0 and 6.7 miles east of Vacaville. Estimated cost, $89,000.

Rights-of-way on various state highway routes—$75,000.

Stanislaus County

Widen Route 132 from 28 to 40 feet by constructing shoulders between Welty Road in San Joaquin County and the west city limit of Modesto at Carpenter Road, Stanislaus County, a distance of 14.3 miles. Estimated cost, $700,000. (Also listed in San Joaquin County.)

Realign Route 132 at Hazel Dean Road to ease curves, between 2.9 and 3.4 miles east of Waterford. Estimated cost, $75,000.

$1,992,000 to complete the financing for extending the four-lane Interstate 5 (Westside) Freeway construction, now nearing completion in Merced County between Route 152 west of Los Banos and 2.8 miles north of Route 33, southwest of Gustine, another 36.1 miles northerly through Stanislaus County to the San Joaquin county line. The project involves constructing interchanges at Sullivan, Stuhr, Fink-Ward, Del Puerto Canyon and Ingram Creek Roads, and bridges across the Delta-Mendota Canal, 10 creeks and the California Aqueduct. Roadside safety rests are being provided on each side of the freeway just south of the San Joaquin county line. A vista point is being constructed for southbound traffic approximately 1.5 miles south of Orestimba Creek, and for northbound traffic at Salado Creek in Stanislaus County. Estimated cost, $17,443,000, of which $15,240,000 had been budgeted in the 1965–66 fiscal year. The Department of Water Resources has contributed $211.000 of the overall cost. (Also listed in Merced County.)

Rights-of-way on various state highway routes—$626,000.

Tulare County

Landscape the Route 198 Freeway between West Main Street and 0.3 mile east of Ben Maddox Way in Visalia, a distance of three miles. Estimated cost, $465,000.

Rights-of-way on various state highway routes—$798,000.

Tuolumne County

Construct 5.4 miles of Route 132 on improved alignment between 0.5 mile west of the Tuolumne-Mariposa county line and 4.1 miles west of Coulterville. Estimated cost, $1,180,000. (Also listed in Mariposa County.)

Place base and surface on a previously graded roadbed to extend the four-lane Route 108 Expressway as a two-lane facility bypassing Twain Harte, between 8.6 miles east of Sonora and one mile east of Twain Harte, a distance of three miles. The project includes constructing an overhead structure across a lumber company's railroad tracks. Estimated cost, $800,000.

Rights-of-way on various state highway routes—$120,000.

LOS ANGELES REGION PROJECTS

Los Angeles County

Extend the eight-lane Interstate 5 Freeway northerly from Castaic Creek, south of Castaic, to construction in progress at the summit of the Five Mile Grade, a distance of approximately 11 miles. The project involves constructing interchanges at Hasley Canyon Road, Parker Road and Violin Canyon Road, and a bridge across Castaic Creek. Estimated cost, $17,000,000, of which $8,400,000 will be budgeted in the 1967–68 fiscal year.

$9,000,000 to complete the financing for grading the future eight-lane Interstate 5 Freeway between 6.8 miles north of Parker Road at Castaic and approximately 15 miles south of the Kern county line, a distance of 12.4 miles. Estimated cost, $31,700,000, of which $22,700,000 had been budgeted in the 1965–66 fiscal year.

$1,800,000 to complete the financing for constructing the eight-lane Interstate 5 Freeway between 6.8 miles south and 0.6 mile north of Route 138; and for constructing a four-lane freeway on Route 138 from the Interstate 5 Freeway to 2.1 miles easterly of Interstate 5. The project involves constructing interchanges with Quail Lake and Hungry Valley Roads and Route 138. Estimated cost, $8,800,000, of which $7,000,000 had been budgeted in the 1965–66 fiscal year.

Construct an interchange on the Interstate 5 (Golden State) Freeway at McBean Parkway (former De Witt Canyon Road), west of Saugus. Estimated cost, $400,000.

Landscape portions of the Interstate 5 (Santa Ana) Freeway between Carmenita Road in Norwalk and 0.2 mile north of Florence Avenue at the border of Downey and Santa Fe Springs. Estimated cost, $357,000.

Replacing a pedestrian crossing under the Interstate 5 (Santa Ana) Freeway with a pedestrian overcrossing at Eastern Avenue in the East Los Angeles area, and attaching a directional sign. Estimated cost, $90,000, of which the state will pay $80,000, and the county the balance.

$3,391,000 to complete the financing for adding auxiliary lanes to the Interstate 5 (Golden State) Freeway between 0.1 mile north of Colorado Boulevard in Los Angeles and 0.2 mile south of Western Avenue in Glendale; for completing the interchange between the Interstate 5 (Golden State) Freeway and the Route 134 Freeway in Los Angeles; and for constructing the eight-lane Route 134 Freeway easterly from this interchange across the Los Angeles River to 0.2 mile east of San Fernando Road in Glendale. The project involves constructing an interchange between the Route 134 Freeway and San Fernando Road. Estimated cost $8,391,000, of which $5,000,000 had been budgeted in the 1965–66 fiscal year.

Extend the eight-lane Route 134 Freeway (between its interchange with Interstate 5 and 0.2 mile east of San Fernando Road in Glendale) 2.9 miles easterly to the east city limit of Glendale, and construct 0.4 mile of embankment easterly from this point for future freeway construction. The project involves constructing interchanges at San Fernando Road, Pacific Avenue, Central Brand Avenue, and Glendale Avenue, and portions of the interchange with the future Route 2 Freeway.

Modify traffic signals, highway lighting and channelization on Colorado Boulevard (Route 134) between Broadway and the existing Colorado Freeway in the Eagle Rock area of Los Angeles, a distance of two miles. Estimated cost, $160,000, of which the state will pay $90,000, and the city the balance.

Construct the eight-lane Interstate 210 (Foothill) Freeway between Santa Anita Avenue in Arcadia and Highland Avenue in Duarte, a distance of four miles. This project involves constructing interchanges at Santa Anita Avenue, Huntington Drive, Myrtle Avenue, Mountain Avenue and Buena Vista Street. Undercrossings at eight city streets between Magnolia Avenue in Monrovia and Highland Avenue in Duarte were budgeted in the 1965–66 fiscal year. Estimated cost, $13,550,000, of which $4,550,000 will be budgeted in the 1967–68 fiscal year.

Construct the eight-lane Route 91 Freeway between 0.2 mile west of Lakewood Boulevard in Bellflower and Artesia Boulevard in Dairy Valley, a distance of five miles. The project involves constructing interchanges at Bellflower Boulevard, Pioneer Boulevard and Norwalk Boulevard, and partial interchanges at Lakewood Boulevard, Clark Avenue, Studebaker Road and Bloomfield Avenue. Estimated cost, $12,400,000.

Widen Artesia Boulevard (Route 91) between Pioneer Boulevard in Artesia, Los Angeles County, and Knott Avenue in Buena Park, Orange County, a distance of 4.1 miles, and install traffic signals and highway lighting. Estimated cost, $765,000, of which the state will pay $660,000, and the Cities of Dairy Valley, La Mirada and Buena Park, and the Los Angeles Flood Control District will pay the balance. (Also listed in Orange County.)

Resurface, widen and install channelization on Artesia Boulevard (Route 91) between Sepulveda Boulevard (Route 1) in Hermosa Beach and Pier Avenue in Redondo Beach, a distance of 0.8 mile. Esti-

mated cost, $250,000, of which the state will pay an estimated $150,000 and Hermosa Beach, Manhattan Beach and Redondo Beach the balance.

Construct the eight-lane Route 90 Freeway between Centinela Boulevard and Slauson Avenue in Los Angeles, a distance of 1.5 miles, and complete its interchange with the Interstate 405 (San Diego) Freeway, portions of which were previously budgeted. Estimated cost, $6,500,000.

Pave the four-lane Antelope Valley (Route 14) Freeway between Avenue I, west of Lancaster, and 0.4 mile north of the Kern county line, a distance of 8.4 miles. Grading and structures were financed in the 1965–66 fiscal year. Estimated cost, $4,400,000. (Also listed in Kern County.)

Widen Sierra Highway (Route 14) from three to four lanes between Soledad Canyon Road and 1.9 miles southwesterly. Estimated cost, $345,000.

Grade and pave the eight-lane Route 170 (Hollywood) Freeway between 0.1 mile north of Victory Boulevard and 0.3 mile north of Sherman Way in Los Angeles, a distance of 1.2 miles. The project involves constructing an interchange at Sherman Way. Portions of the grading were financed in a previous budget. Estimated cost, $3,800,000.

Widen the Ventura (US 101) Freeway from six to eight lanes between 0.3 mile east of Topanga Canyon Boulevard (Route 27) and 0.3 mile west of Mulholland Drive, a distance of 2.7 miles. Estimated cost, $2,450,000.

Install a traffic control system for northbound traffic on the Hollywood (US 101) Freeway between the Mulholland Drive and Barham Boulevard Overcrossing to give advance warning in the event of traffic slowdown ahead, and possibly reduce the speed of drivers approaching both a hill and a curve with restricted visibility. Estimated cost, $90,000.

Widen Venice Boulevard (Route 187) from four to six lanes with channelization, traffic signals and a curbed median between Sepulveda Boulevard adjacent to Culver City, and the Interstate 10 (Santa Monica) Freeway in Los Angeles, a distance of 2.9 miles. Estimated cost, $2,400,000, of which the state will pay $1,200,000, and the cities and county the balance.

Landscape the Interstate 10 (Santa Monica) Freeway in Los Angeles between Overland Avenue and 0.3 mile east of La Cienega Boulevard, and between West Boulevard and Vermont Avenue, a total distance of 5.5 miles. Estimated cost, $682,000.

Add an eastbound on-ramp to the Interstate 10 (San Bernardino) Freeway at the Hoyt Avenue Interchange in El Monte. The project involves widening Hoyt Avenue at the interchange and installing traffic signals. Estimated cost, $235,000, of which the State will pay $217,000, and the city the balance.

Construct an interchange on the Pomona Freeway (Route 60) at Paramount Boulevard in Montebello. Estimated cost, $550,000.

Modify traffic signals and safety lighting at 12 intersections on Fifth Avenue (Route 60) between Hansen Avenue in Pomona and Roswell Avenue in San Bernardino County. Estimated cost, $106,000, of which the State will pay $55,000, and Pomona and San Bernardino County the balance.

Improve drainage and reconstruct Whittier Boulevard (Route 72) between Bluff Road and Garfield Avenue in Montebello, a distance of 1.7 miles, and install and modify traffic signals and highway lighting at 11 intersections. Estimated cost, $580,000, of which the State will pay $400,000 and Montebello the balance.

Landscape portions of the Interstate 405 (San Diego) Freeway between 0.2 mile south of Burbank Boulevard and the Interstate 5 (Golden State) Freeway in the San Fernando Valley area of Los Angeles, and construct a landscape maintenance building immediately west of the interchange between Interstate 5 and Interstate 405. Estimated cost, $307,000.

Install and modify traffic signals, highway lighting and channelization on Hawthorne Boulevard (Route 107) at the Interstate 405 (San Diego) Freeway ramp connections, and at Manhattan Beach Boulevard in Lawndale. Estimated cost, $70,000.

Widen Rosemead Boulevard (Route 164) from four to six lanes between 0.2 mile north of the Pomona Freeway (Route 60) in the South San Gabriel area of Los Angeles County and Garvey Avenue in South El Monte, a distance of 1.3 miles. Estimated cost, $250,000, of which the state will pay $200,000, and South El Monte the balance.

Landscape the Long Beach (Route 7) Freeway between the Interstate 10 (San Bernardino) Freeway and Valley Boulevard in Los Angeles, a distance of 1 mile. Estimated cost, $282,000.

Widen the ramp connection from the northbound Long Beach (Route 7) Freeway to the Interstate 405 (San Diego) Freeway near Long Beach, and modify signs. Estimated cost, $140,000.

Modify traffic signals and highway lighting at nine intersections between the south junction of Canada Boulevard (Route 2) and Crescenta Avenue in Glendale, a distance of 1.5 miles, and resurface the portion of this highway between Towne Street and Verdugo Road in Glendale. Estimated cost, $190,000, of which the state will pay $135,000, and the city the balance.

Resurface and reconstruct portions of Pacific Coast Highway (Route 1) between Crenshaw Boulevard and Avenue I in Torrance, a distance of 3.4 miles. Estimated cost, $130,000.

Widen Colima Road (Federal Aid Secondary Route 1274) to a four-lane divided highway as an urban extension project between Mar Vista Street and Whittier Boulevard in Whittier, a distance of 1 mile. Estimated cost, $860,000, of which the state will pay $430,000 and local agencies the balance.

Widen Azusa Avenue (Federal Aid Secondary Route 634) to a four-lane divided highway as an urban extension project between Amar Road and Renault Street in Industry. Estimated cost, $492,000, of which the state will pay $246,000 and Industry, La Puente, West Covina and Los Angeles County the balance.

Rights-of-way on various state highway routes—$72,000,000.

Orange County

Extend a previously budgeted section of the Interstate 405 (San Diego) Freeway approximately 4.5 miles northwesterly from 0.2 mile northwest of Jamboree Road, northeast of the Orange County Airport, to Harbor Boulevard in Costa Mesa. The project involves constructing interchanges at Bristol Street, Fairview Road and Harbor Boulevard. Estimated cost, $11,900,000, of which $1,100,000 will be budgeted in the 1967–68 fiscal year.

Widen the Interstate 5 Freeway from four to eight lanes between Route 1 south of San Juan Capistrano and the Interstate 405 (San Diego) Freeway, and to six lanes from this point northwesterly to the Route 133 (Laguna Canyon Road) Freeway, a distance of 16.4 miles. Estimated cost, $12,500,000, of which $7,000,000 will be budgeted in the 1967–68 fiscal year.

Construct the eight-lane Route 57 (Orange) Freeway between the Riverside (Route 91) Freeway east of Anaheim and Orangethorpe Avenue in Placentia, a distance of 0.8 mile, plus portions of an interchange with the Riverside Freeway, plus an interchange at Orangethorpe Avenue; and add 1.9 miles of auxiliary lanes to the Riverside Freeway between Placentia Avenue at the Anaheim-Placentia border and Dowling Avenue in Anaheim. Estimated cost, $5,000,000.

Landscape the interchange area of the Interstate 5 (Santa Ana) Freeway, Garden Grove (Route 22) Freeway, and the future Orange (Route 57) Freeway in Santa Ana and Orange and construct a landscape maintenance building in this vicinity. Estimated cost, $502,000.

Widen Brea Boulevard (Route 57) from two to four lanes between Harbor Boulevard (Route 72) in Fullerton and Acacia Street in Brea, a distance of 2.2 miles. Estimated cost, $165,000, of which the state will pay $125,000, and the city the balance.

Widen Artesia Boulevard (Route 91) between Pioneer Boulevard in Artesia, Los Angeles County, and Knott Avenue in Buena Park, Orange County, a distance of 4.1 miles, and install traffic signals and highway lighting. Estimated cost, $765,000, of which the state will pay $660,000, and the cities of Dairy Valley, La Mirada and Buena Park, and the Los Angeles Flood Control District, the balance. (Also listed in Los Angeles County.)

Reconstruct portions and resurface Santa Ana Canyon Road (Route 91) between Crescent Drive and the Riverside county line, 8.9 miles easterly. Estimated cost, $400,000.

Landscape the area of the interchange etween the Interstate 405 (San Diego) reeway, the Interstate 605 (San Gabriel iver) Freeway, the Route 22 (Garden rove) Freeway and the Route 240 Free-ay near Seal Beach and Long Beach. Es-imated cost, $766,000.

Widen Broadway-Laguna Canyon Road Route 133) to 24 feet and construct shoul-ders between 0.2 mile north of Canyon Acres Drive in Laguna Beach and Laguna Road south of Irvine, a distance of 6.5 miles. Estimated cost, $470,000.

Widen MacArthur Boulevard (Route 73) from two to four lanes and modify traffic signals between Ford Road and the Interstate 405 (San Diego) Freeway, northeast of the Orange County Airport, a distance of 2.6 miles. Estimated cost, $440,000.

Widen portions of the Pacific Coast Highway (Route 1) between Warner Avenue near Huntington Harbor and Bay Boulevard in Seal Beach, and construct channelization and modify traffic signals. Estimated cost, $335,000, of which the state will pay $310,000, and Huntington Beach and Orange County the balance.

Rights-of-way on various state highway routes—$6,000,000.

SAN BERNARDINO AND RIVERSIDE COUNTIES PROJECTS

Riverside County

$1,900,000 to complete the financing for onstructing the four-lane Interstate 10 Free-ay between 1.3 miles west of Wiley Wells oad, about 18 miles west of Blythe, and 2 miles east of Desert Center, a distance f 27.4 miles. This project will cost an timated $6,900,000 of which $5,000,000 had een budgeted in the 1965–66 fiscal year; id $8,000,000, of which $4,900,000 will be idgeted in the 1967–68 fiscal year, for ex-nding this construction another 20.6 miles esterly to four miles east of Cottonwood prings Road. The latter project involves onstructing a pair of safety roadside rests Cactus City and interchanges at Eagle ountain and Rice Roads.

Add four lanes to Interstate 10 between oute 111 and Garnet, a distance of 9 miles, id construct interchanges at Whitewater id Garnet to convert this section from ex-ressway to full freeway standards. Estimated ost, $4,200,000.

Widen Route 111 from two to four lanes twen Miles Street west of Indio and eep Canyon Road, 2.8 miles westerly. Es-nated cost, $450,000.

Reconstruct Route 195 between Route 86 d Route 231, southwest of Mecca, a dis-nce of 5.4 miles. Estimated cost, $290,000.

Landscape the interchange between US 5, US 60 and Route 91 in Riverside, and stretch of US 395 fronting the University California at Riverside. Estimated cost, 25,000.

Resurface and widen Route 74 from two four lanes between three miles east of S 395 and Homeland, a distance of 1.8 les. Estimated cost, $170,000.

Install traffic signals at the Route 91 Free-y connections with Arlington Avenue, ntral Avenue and 14th Street in River-e. Estimated cost, $100,000, to be shared ually by the state and city.

Widen Alessandro Boulevard (Federal d Secondary Route 1249) from two to ur lanes as an urban extension project be-een Canyon Crest Drive and Chicago enue in Riverside, a distance of 1.9 miles. Estimated cost, $403,600, of which the state will contribute $201,800, and Riverside the balance.

Rights-of-way on various state highway routes—$2,980,000.

San Bernardino County

Construct the eight-lane Interstate 15 Freeway on new alignment between Devore and Route 138 at Cajon, a distance of approximately 10.3 miles. The project involves constructing an interchange with the future Route 31 Freeway (Devore Cutoff) and constructing the first unit of approximately 1.8 miles of the Route 31 Freeway southerly from the interchange. Estimated cost, $20,000,000 of which $15,000,000 will be budgeted in the 1967–68 fiscal year.

Construct a connecting four-lane freeway between Interstate 15 near Baseline Street in San Bernardino and Route 30, and a six-lane freeway on Route 30 between this point and Waterman Avenue (new Route 18), a distance of 2.4 miles, and construct Waterman Avenue as a four-lane conventional highway between 40th Street and the north city limit of San Bernardino, a distance of 0.9 mile. The freeway construction involves constructing interchanges at Interstate 15, Highland Avenue, E Street and Waterman Avenue, and the installation of traffic signals and channelization between Route 30 and the north city limit. Estimated cost, $6,870,000, of which $1,160,000 will be budgeted in the 1967–68 fiscal year.

$4,900,000 to complete the financing for constructing a four-lane freeway on Interstate 40 between 2.5 miles east of Daggett and 8.5 miles west of Ludlow, a distance of 31.8 miles, with interchanges at Airport Road, the existing highway at Newberry, Fort Gady Road and Hector Road; an overhead across the A.T. & S.F. Railroad tracks, about 10 miles west of Ludlow; and 10 bridges across washes. Estimated cost, $11,900,000, of which $7,000,000 had been budgeted in the 1965–66 fiscal year.

$300,000 to complete the financing for constructing a four-lane freeway on Interstate 40 between 0.5 mile east of Java and the north city limit of Needles, a distance of 4.8 miles. Estimated cost, $2,700,000, of which $2,400,000 had been budgeted in the 1965–66 fiscal year.

Relocate Route 138 as a four-lane expressway between Summit Valley and Cleghorn Road north of Crestline, a distance of 3.7 miles, in connection with the future construction of the Cedar Springs Reservoir which will inundate the existing highway. Estimated cost, $2,700,000, of which State Highway funds will pay $500,000, and the Department of Water Resourecs the balance.

Replace the Mount Vernon Avenue Interchange on the Interstate 10 Freeway in Colton in connection with a county project for improving this road and its elevation across the Southern Pacific Company's railroad tracks immediately south of the freeway. As rebuilt, the interchange will serve the future widening of the freeway at this location. Estimated cost, $1,650,000, of which the state will pay $600,000 and the county the balance.

Convert Route 18 from a two-lane highway to a four-lane expressway between 0.8 mile and 3.4 miles north of the San Bernardino city limit. Estimated cost, $1,000,000.

Eliminate dips and humps at 12 locations on Route 62 between Yucca Valley and 5 miles west of Twentynine Palms. Estimated cost, $130,000.

Modify traffic signals and safety lighting at 12 intersections on Fifth Avenue (Route 60) between Hansen Avenue in Pomona and 0.1 mile east of that city in San Bernardino County. Estimated cost, $106,000, of which the State will pay $55,000, and Pomona and San Bernardino County the balance. (Also listed in Los Angeles County.)

Resurface and widen Route 30 from two to four lanes between Patton and Route 106, a distance of 0.9 mile, and install traffic signals at Palm Avenue. Estimated cost, $100,000.

Rights-of-way on various state highway routes—$6,071,000.

SAN DIEGO AND IMPERIAL COUNTIES

San Diego County

Extend eight-lane Interstate 5 Freeway nstruction in progress (between just north Palm Avenue in San Diego and 0.2 mile th of the San Diego River) northerly to ther project north of Tecolote Creek, l extend this construction to 0.5 mile north of Balboa Avenue. The new project involves completing the interchange with Interstate 8, Route 209 and the future Route 109, constructing paired freeway bridges across the San Diego River, relocating a sewer in the path of the freeway construction, and constructing an interchange at Clairmount Boulevard. Estimated cost, $17,370,000, of which the state will pay $17,030,000 (of which, $9,530,000 will be budgeted in the 1967–68 fiscal year), and the City of San Diego the balance.

Extend a budgeted eight-lane freeway section on Interstate 5, between Oceanside

and south of San Clemente, 8.9 miles northerly to 0.2 mile north of the San Diego-Orange county line, with an interchange at San Onofre Road. This project, together with others completed, under construction or budgeted, will provide full freeway from the Mexican border to northern Los Angeles County. Estimated cost, $7,400,000, of which $2,400,000 will be budgeted in the 1967–68 fiscal year. (Also listed in Orange County.)

$4,084,000 to complete the financing for extending the eight-lane Interstate 5 Freeway 9.7 miles northerly between 0.4 mile north of the San Luis Rey River at Oceanside and two miles north of Las Pulgas Road, about 12 miles south of San Clemente, with an interchange at Las Pulgas Road. Estimated cost, $9,784,000, of which $5,700,000 had been budgeted in the 1965–66 fiscal year.

Landscape and install functional planting on the Interstate 5 Freeway between 0.2 mile south of 24th Street in National City and 28th Street in San Diego, a distance of 3.6 miles. Estimated cost, $630,000.

Extend the four-lane Interstate 8 Freeway 5.3 miles easterly to 2.5 miles east of Alpine, and construct an interchange at Tavern Road. Estimated cost, $7,100,000, of which $5,100,000 will be budgeted in the 1967–68 fiscal year.

$4,370,000 to complete the financing for extending the four-lane Interstate 8 Freeway section in the Mountain Springs area, near the San Diego-Imperial county line, another 10 miles westerly to County Road J-35 near Boulevard, with interchanges at Carrizo Gorge Road near Jacumba, and at Inkopah County Park at the county line. The project involves constructing bridges across Carrizo Creek, and an overhead across the San Diego and Arizona Eastern Railroad tracks near Jacumba. Estimated cost, $8,370,000, of which $4,000,000 has been budgeted in the 1965–66 fiscal year.

Landscape and plant trees along portions of the Interstate 8 Freeway in San Diego between Presidio Interchange and Fletcher Parkway. Estimated cost, $490,000.

Improve ramps and weaving sections on the Interstate 8 Freeway in San Diego between Route 103 and Fairmount Avenue, a distance of 0.7 mile. Estimated cost, $200,000.

Construct the first unit of the eight-lane Interstate 805 Freeway in San Diego between 0.2 mile north of Home Avenue and Interstate 8, a distance of 3.6 miles. The project involves constructing interchanges at University Avenue and El Cajon Boulevard, and a partial interchange at Madison Avenue. Estimated cost, $11,000,000, of which $9,400,000 will be budgeted in the 1967–68 fiscal year.

Construct an interchange on the Route 103 (Murphy Canyon Road) Expressway at Friars Road in San Diego. Estimated cost, $2,350,000, of which the state will pay $2,100,000, and the city and county the balance.

Grade and pave to complete a recently advertised project for the construction of a six-lane freeway on Route 67 between Interstate 8 at El Cajon and 1.7 miles northerly. Estimated cost, $1,000,000.

Pave the four-lane Route 94 Freeway between 0.5 mile east of the Route 125 (former Route 67) Freeway and Conrad Drive in Spring Valley, a distance of 1.1 miles. Estimated cost, $760,000.

Construct an interchange on Route 78 at College Boulevard near the boundary of Oceanside and Carlsbad. Estimated cost, $750,000.

Extend Route 78 in Escondido as a two-lane highway 0.9 mile easterly from its present terminus at US 395 to Broadway, pending freeway construction on this route. Estimated cost, $297,000.

Install channelization at the intersections of Rosecrans Avenue (Route 209) with Lytton, Evergreen and Hancock-Moore Streets in San Diego. Estimated cost, $100,000.

Construct Friars Road (Federal Aid Secondary Route 731) as a four-lane divided urban extension between 0.1 mile west of Mission Village Drive and Mission Gorge Road near San Diego, a distance of 1.3 miles. Estimated cost, $2,076,000 of which the state will divide $1,000,000 between the city and county. The balance will be paid by the two agencies.

Rights-of-ways on various state highway routes—$16,547,000.

Imperial County

$3,057,000 to complete the financing of a project estimated to cost $6,057,000, of which $3,000,000 had been budgeted in the 1965–66 fiscal year, for constructing a four-lane Interstate 8 Freeway section between 0.4 mile east of Route 111 and 0.4 mile west of Imperial Avenue in El Centro, and an estimated $4,375,000 for extending this construction 7.5 miles westerly to 0.5 mile west of Federal Aid Secondary County Road 724 south of Seeley. The latter project involves constructing a safety roadside rest for eastbound traffic near Sunbeam Lake.

Rights-of-way on various state highway routes—$653,000.

One of three bridges designed and constructed by the Division of Highways which won an award this year in national competition sponsored by the American Institute of Steel Construction was this highway grade separation on Interstate 280 and Route 17 a few miles northeast of San Jose.

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